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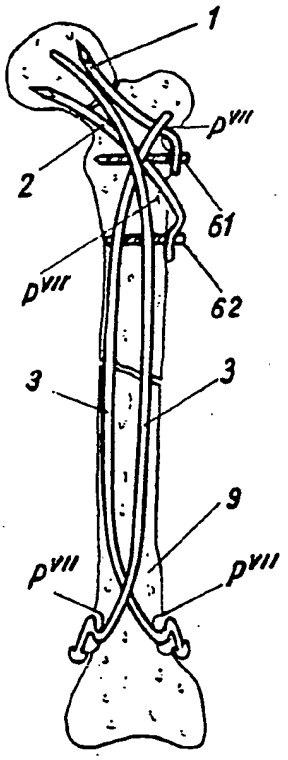
(57) Abstract

Flexible implants (1, 2, 3) for the stable flexible osteosynthesis of the femur and tibia fractures. In order to achieve osteosynthesis stabilizing the fracture gaps, they are made of short rods (1, 2), one upper and one lower, used in the osteosynthesis for the fracture of the femoral neck, as well as of a long rod (3), used as such or with another long rod (3) and with the short rods (1, 2) in case of stabilizing the double gap fractures crossing the femur neck and every part of the femur placed under the greater trochanter, or only with another long rod (3) for stabilizing the diaphysary fractures of tibia and femur. Working instrumentation required for achieving an efficient surgical operation in the stable flexible osteosynthesis by means of the flexible implants (1, 2, 3) are also disclosed.



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FLEXIBLE IMPLANTS FOR STABLE FLEXIBLE OSTEOSYNTHESIS OF FRACTURES OF FEMUR AND TIBIA, RESPECTIVELY AND WORKING INSTRUMENTATION

The present invention refers to flexible implants used in the stable flexible osteosynthesis of femoral neck and greater trochanter fractures, of subtrochanterian, mediodiaphysary, super- and intercondylian fractures of femur and of diaphysary fractures of tibia, as well as to the working instrumentation required for the introduction/extraction of the flexible implants in/from the bone.

There are known flexible implants for the osteosynthesis of gaps of tibia diaphysary fracture and of femur super-intercondylian, mediodiaphysary and subtrochanterian fractures or of the instable fractures of the greater trochanter, made up of a long, thin body provided with a long middle part, connected through a curved part to short, fore and, respectively, posterior end parts, the posterior one being continued with a flattened part in which a window is made, as well as flexible implants for the osteosynthesis of the gaps of femoral neck fracture, which are made up of a body provided with a straight, long part connected through a curved part to a short end part, the straight part being continued with a flattened posterior part in which a window or a stick-shaped part is provided.

The disadvantages of these implants consist in the fact that the mounting finally obtained by introducing more than two flexible implants in the bone, in view of stabilizing the gap of fracture is difficult to be achieved and is highly rigid, which uselessly prolong the surgery time, also creating, due to the rigidity, biomechanical conditions not promoting the fracture healing, and their fastening in the bone does not offer reliability in course of the time, since there is the possibility of their slipping, which may appear outside the bone, perforating thus the tegument, or in the medullary channel, a fact which leads to the loss of the fracture gap stabilization.

There are known instrumentations for the introduction/extraction of a flexible implant in/from the bone, containing an instrument for hammering a thin, long, flexible implant, made up of a body provided with an active end, having a plugged channel in which the flattened

part of the implant penetrates and in a middle zone of the body a pierced hole is made through which a rod is introduced, by means of which the implant position can be changed during the hammering (Franch patent No.223760 9), an instrument for extracting the flattened part of the implant from the bone diaphysis cortical shell, in view ofcreating the possibility of its extraction from the bone, made up of an elongated body, provided with a key-shaped active end and a circular collar-provided end and a short flattened part between which there is a cylindrical part (Synthes), an instrument also used for lifting the flattened part of the implant, formed of a body having an active flattened end, upward curved (prospectus OEC-B76), an instrument for making a hole in the bone for the introduction of the long flexible implant according to a certain line, made up of a body with a straight part, delimited by fore and, respectively, posterior parts, inclined as against the straight part, the fore part being continued with an active end, upward curved, with four edges converging to the top, each edge being formed of two straight parts making an obtuse angle (prospectus OEC - B58), an instrument for the extraction of the long flexible implant from the bone, made up of a long body ended with a stick-shaped end and a handle, the stick-shaped end being located in the window made in the flattened part of the implant (catallogue AESCULAP, page 42), an instrument for hammering the implants in case of stabilizing the femoral neck gap of fracture, made up of a crank-shaped body, ended with a lower, active end in which a plugged channel is made so as to accomodate the flattened part of the implant, and in the middle zone of the body a rod is mounted for positioning during the implant hammering (Frenoh patent No.223760 9), an instrument for modifying the curvature of the flexible implants, made up of a handle to which a body is fastened, this body being provided with two fixed jaws, inclined as against a horizontal plane, delimiting an opening in which the implant is introduced (catalbgue AESCULAP, page 27), an instrument for guiding the long flexible implant during the hammering, made up of a long, cylindrical body, in which the long flexible implant is introduced, the body being provided with a threaded end which is fastened into the coupling of an anvil, to which a rod is mounted for positioning the implant during the hammering (French patent No.223760 9), an instrument for extracting an implant from the bone, provided with a stick-shaped rear end, formed respectively of a long body ended with a handle and of a plate-shaped, flattened part, upward curved, having an end part backward directed (prospectus OEC, 02), an instrument for achieving an impact in view of extracting the flexible implant from

the bone, formed of a cylindrical body to which a tail is jointed by means of two bolts, so that one may avoid during the hammering the ris of seizing the body to the rod of the extraction instrument (prospectus OEC-A59), and an instrument for fastening the implant, in view of its curving, made up of a support to which a body is fastened in which a recess is made for mounting a fixed lower jaw, upward shaped, and a moving upper jaw supported by a rod actuated through an eccentric by a handle (catallogue AESCULAP, page 27), an instrument for creating the impact force, made up of a tail provided with a longitudinally elongated window to which it is fastened a cylindrical active end, finished with flat surfaces, the tail fastening to the end being made in the middle zone of the latter (catallogue AESCULAP, page 27), an instrument for pushing a flexible implant into the bone, formed of a cylindrical body ended with an anvil and a cylindrical active end with the external diameter higher than that of the body rest, in which it is made a circular channel delimited by a straight wall, in which there may be introduced respectively the flattened part of the implant and a multi-functional handle, formed of a tail to which there is fastened a body, in which a longitudinal channel is made, its fore part being delimited by a shaped wall, the channel communicating with a transversal channel in which a yoke-ended lock is mounted under the action of the force stored in a spring (catalogue SYNTHESIS).

The disadvantages of these instrumentations consist in the fact that the instruments for hammering a long, flexible implant, for removing away the flattened part of the implant from the bone diaphysis cortical shell, for hammering the implants in the cases of stabilizing the fracture gaps of the femoral neck, for guiding the long flexible implant, and, respectively, for pushing the implant into the bone cannot be used except under the conditions when the implant is ended with a flattened part or with a stick-shaped end, the instrument for curvature modifying does not allow the proper fastening of the implants, except in the middle zone, the instrument provided with a plate-shaped part for the detachment from the bone cannot be used, except in case of the implant with one posterior end shaped as a stick, the instrument for achieving the impact required for the extraction of the flexible implants from the bone is difficult to handle, since it does not allow the rotational motions of the tail, as against the body, the instrument for fastening the implant in view of its curving does not allow its curving, except in the middle zone, the instrument for creating the force of impact requires the application of a relatively big effort when there are necessary impact forces of high va-

lues, and the multi-functional handle does not allow to apply, by mean of it, forces with relatively high values to the instruments fastened to it and it cannot be positioned and kept in the desired position, except by hand.

The object of the present invention consists in achieving osteosyntheses which stabilize the fracture gaps, enabling the patient's recovery in a short period, under the conditions of making less injuring operations, with minimal blood losses and with the possibility of making them in all ages and of minimizing the premature and later local and general complications of the fractures.

The theme solved by the present invention consists in achieving a mounting which stabilizes both the instable fracture gaps and the extension of the principle of flexible osteosynthesis with the known biomechanical benefits for all fractures of femur and tibia diaphysis, the stability of the mountings in course of the time is ensured in case of short flexible implants by their fastening to the diaphysis with an orthopaedic screw, in case of long flexible implants, through the shape of the lower end which is locked in the hole for the introduction into the bone and being seated with the last part on the edge near the hole, the performing of the operation both in case of osteosynthesis with short flexible implants and with long flexible implants is easily made with the instrumentation adapted to the implant shapes and to the needs of the operating times.

According to the present invention, the implants eliminate the disadvantages above mentioned by the fact that they are made of short rods, of which one is upper and the other one is lower, used in the osteosynthesis for femoral bone fracture as well as of a long rod, used as such or with another long rod and with the short rods, in case of stabilizing the fracture with double gap, these ones crossing the femur neck and every part of the femur placed under the greater trochanter or only with another long rod for stabilizing the diaphysary fractures of tibia and femur and, respectively, the super and intercondylian fractures of the femur, the short, upper rod being made up of an upper active part, having a shaped end, continued with an upper part, upward curved, after which there follows a long straight part, connected through a lower curved part, downward directed, with a part inclined as against a horizontal direction, ended with a lug, the lower short rod being made up of an upper, short, straight active part, with a shaped end connected through an upper part, downward curved, with a long part, downward curved, connected in turn by means of an intermediary and, respectively, a lower part, inward and outward curved, with

a part inclin as against the horizontal di. ction, ended with a lug, the long rod being formed of a long, straight part ended with a shaped end, promoting its penetration and directing in the bone, connected through lower and, respectively, upper parts, inward and outward curved, to a flat, narrow part and to an end widened part, which is flat or inward curved, so dimensioned that it stops the complete penetration of the long rod in the medullary channel, the lower, short rod having in the lower curved part, downward directed, a radius of curvature equal to that of the upper part, upward curved, between 1 and 3 cm, and the axis of the upper active part is parallel to the axis of the part inclined as against a horizontal direction and forms with the axis of the long straight part an angle of 4o ... 7o°, the long straight part having a lower, flat surface limited by an upper surface whose cross-sectional area has the shape of a truncated cone, with the small base placed toward the lower, flat surface, the lower short rod having, in the long, downward curved part, a radius of curvature between 7 and 1o cm, and the radii of curvature of the intermediary and, respectively, lower parts, inward and outward curved are equal to each other and have values between 1/2 and 1/3 of the curvature radius of the long, downward curved part, these radii being lower than the curvature radius of the upper, downward curved part, the plane in which there is placed the lug, the latter having a lower, flat surface limited by a truncated cone-shaped area with the small base located toward the lower surface, forming with a horizontal plane an angle of 4o ... 7o° and the axis of the upper, short, straight part forms with a horizontal plane an angle of 4o° ... 7o°, the long rod having the active, shaped end provided with an upper inclination up to 45° and a lower inclination up to 3o° or with edges delimiting some faces converging to the longitudinal axis of the long rod, the lower and, respectively, upper parts, inward and outward curved, having radii of curvature with values between 3 and 5 mm, and the end part is delimited by the flat narrow part, through some steps inclined as against the longitudinal axis of the rod, forming with this one an acute angle of 6o°... 75° symmetrically disposed as against the respective axis, the lower and respectively, upper, inward and downward curved parts being half-flattened, the widths of these parts being equal to the width of the flat, narrow part and with the diameter of the long straight part, respectively.

In accordance with the present invention, the instrumentation eliminates the above mentioned disadvantages since, in order to

stabilize th fracture gaps, under the conditions of performing less injuring operation, with minimal blood losses, for the introduction of the long rod through the hole made in the bone and of the mentioned lower, short rod through the hole made in the bone, there are used an instrument formed of a short body, provided with an active end, with a frontal recess, delimited at the lower side by a lower wall, in which it is made an elongated seat, communicating with a seat made in a vertical wall, sidewise delimiting the recess, the seat shapes being so selected as to enable the penetration of the lower, inward curved part of the long rod in the seat made in the wall, when a fragment of the long, straight part of the long rod penetrates in the elongated seat, and the upper, outward curved part of the respective rod is placed in the frontal recess, opposite to which the body has a circular collar, connected, through a shaped part, with a short rod in which there is provided a central circular seat, a pierced hole being made in the body, its diameter being so selected as to enable the introduction of the long, straight part of the long rod through it, in view of correcting the curvature, reason for which it is also introduced through a pierced hole, made in the long body of an instrument for lifting the long rod in view of its extraction from the bone, the body being ended with an active, upward curved end, in which an upper recess is made being so shaped as to enable the penetration of the straight long part of the long rod, near the lower inward curved part of the long rod, the body having, opposite to the upper recess, a circular collar, connected through a shaped part with a short rod, in which a circular hole is made for the initial introduction of the upper short rod over a depth of 3 ... 4 cm, an instrument being used in the hole made in the bone, the instrument in question being made up of a body to which an anvil and a support are fastened, the anvil having a short, cylindrical part provided with a circular recess and the support has a threaded rod which may be introduced/extracted in/from a L-shaped channel communicating with the outside, made in a band in which there is also worked a longitudinal channel, ended with a circular part, having a dimension higher than that of an end delimiting the recess at the top, so that it is possible to displace the anvil along the channel, when the band is placed in front of the recess, the fastening of the band being achieved by means of a nut threaded on the rod, the body having a straight part, to which the anvil and the support are fastened, delimited respectively by a

short part inclined as against the longitudinal axis of the straight part and also by a part inclined in the same direction as the short part against this axis, the inclined part being connected, through a circular collar and a shaped part, to a short rod, provided with a circular seat, the anvil having an upper, straight part connected with an inclined part with the longitudinal axis parallel to that of the short part, provided with an upper, inclined surface, whose axis is parallel to the longitudinal axis of the inclined part, the band being provided with an end, shaped part having the shape of a circle arc in cross-sectional area, which makes with the longitudinal axis of the straight part an angle lower by $5^{o}...10^{o}$ than the angle formed by the short part with the same axis, the final positioning of the upper, short rod in the neck being made by means of an instrument made up of a short body, ended with a shaped end, inclined with an angle higher than 90^{o} as against the body axis, having a diameter higher than the rest of the body, provided with a straight frontal face, at the respective end, an elongated seat being made, delimited at the rear side by a semi-circular wall so dimensioned that, by introducing the lug of the upper short rod in it, its part inclined as against a horizontal direction remains outside, the body being connected, through a circular collar and a shaped part with a short rod provided with a circular seat, a handle being used for the introduction or the extraction of the short and, respectively, long rods in and from the bone, this handle enabling during the operation to fasten the instrument for introducing the short, the lower and, respectively, the long rods; an instrument for the final hammering of the long rod; an instrument for the final introduction or lifting of the long rod, in view of its extracting in/from the bone; an instrument for lifting the long rod, in view of its extraction; an instrument for achieving the adequate line of introducing the long rod in the bone; an instrument for extracting any of the short and, respectively long rods from the bone; an instrument for hammering the short rods in view of their introducing in the bone; an instrument for the final introduction of the upper short rod; an instrument for modifying the curvatures of the short rod ends; an instrument for detaching the long rod from the bone and, respectively an instrument for introducing the upper, short rod over a depth of 3 ... 4 cm, being possible to rotate the handle during the operation so as to position the long rod in the medullary channel or the lower, short rod in the neck, by means of an instrument formed of a long, cylindrical body ended with a posterior and, respectively, a fore cylindrical collar, with a diameter lower than that of the collar, frontwise

provided with a shaped circular recess so as to enable the introduction of the lower short rod intermediary part or of lower, inward-curved part of the long rod; a handle made up of an outside shaped body, provided with a longitudinal window, ended with a flared part, the window being made in a middle part of the body, continued with a posterior envil and, respectively, an active end of cylindrical shape, in which it is made a longitudinal, cylindrical channel, continued with a recess delimited by a shaped wall communicating with the outside through a cylindrical seat, in a plane perpendicular to the plane in which there is placed the channel, in the active end a cylindrical channel being made, its longitudinal axis being placed under the axis of the longitudinal channel, communicating with the outside through recesses and opposite located, the respective channel accomodating a lock provided with a fore, thin part and a posterior, thick, cylindrical part in which there are made two circular channels shifted as against the transversal axis of the channel, the fore part being mounted under the action of a force stored in a spring, which is supported respectively on a shoulder limiting the recess and also on a fore stopper, mounted in connection with the lock, with the possibility of displacement in the recess, which allows to bring, as the case may be, the thin part in front of the channel from the recess where a posterior stopper is located having the possibility of displacing and with which the lock makes a single piece, the channel communicating with another channel placed in the same plane as the other channel, perpendicular to the latter, in which, under the action of the force stored in a spring, a ball is placed, this ball penetrating depending on the lock position in one of the channel, the keeping of the spring in the channel being made by means of a screw, the rotation of the handle around the longitudinal axis depending on the needs, when introducing the lower, short rod or the long rod in the bone, is made by means of the instrument for finally introducing the mentioned rods in the bone, which is placed in the flared part of the longitudinal window, all instruments which are handled by means of the handle having one of some collars connected through one of the shaped parts with one of the short rods, provided with one of the circular seats, which enables their locaking; for guiding the long rod during its initial introduction in the bone, in other constructive version, it contains an instrument fastened in the handle, formed of a long body, in which a jaw is fastened by means of a nut, the body having a long part connected through a circular collar and

a shaped part with a short rod, provided with a circular seat, opposite to the collar, the body being provided with a jaw provided on the frontal surface with a semi-circular recess, having the longitudinal axis parallel to that of the long part, the jaw being continued with a short rod, outside threaded, having the longitudinal axis in the extension of the long part which serves for guiding the jaw, reason for which the latter has a pierced hole through which the rod penetrates, a recess having the same shape as the semi-circular recess being positioned in front of the jaw recess, by fastening the jaw by means of a nut; for modifying the curvatures of the lower, downward curved and, respectively, outward curved parts of the short, upper and, respectively, lower, outward curved parts of the short, upper and, respectively, lower rods and of the straight, long part of the long rod, depending on the needs, due to the bone shape; in another constructive version, it contains an instrument made up of a sleeve with sidewise flared edges, jointed with a short bolt, with a U-shaped support, in which there are made a recess and, respectively, some marginal, longitudinal slits, separated from the recess by a wall, a stopper being fastened to the support, the former coming into contact with the two short, posterior arms jointed in turn with a short bolt to two fore short arms, the latter being bolt-jointed to the support, a long, sidewise flattened part being also bolt-jointed in front of the recess, pierced holes being drilled along the longitudinal axis of this part, which has an external, circular collar, used for limiting the displacement of a sleeve along it, as a result of the contact between the collar and a lower edge of the sleeve, which is sidewise cut so that it may come in contact, sidewise, with the part, pierced holes being drilled in the sleeve, having the same diameter and the same distance between them as those of the holes from the long part, beside the holes which are placed along the longitudinal axis of the sleeve, the latter having also near a fore, inclined end, two holes located on either side of the longitudinal axis, the sleeve being possible to be closed with a plate, in which there are mounted thick bolts, which may penetrate through the holes from the long part and from the sleeve and, respectively, thin bolts which may penetrate in the holes near the fore end of the sleeve, the arms being provided, in order to achieve more accentuated curvatures of the long part of the long rod, with upper recesses communicating with the outside, placed at the same level when the arms are brought in working position, in which it is

introduced the rod, which is, in this position, located under the long part and the sleeve, by displacing downward the sleeve and implicitly the part, the rod being curved, the modification of the rod curvatures according to the bone shape being made by means of the sleeve and bolts between which there are introduced the rods, as the case may be, by keeping the part in the working position, through the holes drilled in the arms in which a bolt is introduced, the bolt in question being mounted, when not working, in the holes made in the supports, in some lower ends of the arms, being introduced in slits; for transportation or sterilization requirements the sleeve together with the arms and, respectively, the long part, are rotating around the bolt, so as to bring them in the perimeter delimited by the support, position in which they are located under the wall, and the sleeve is folded around the bolt, being locked in the support, the bolts being secured by nuts against loosening, and for preventing the displacement of the component parts during the transport, namely the short arms and the part, two spacing parts are provided.

Examples are given below for the achievement of flexible implants and of the instrumentation, according to the present invention, related to fig.1 ... 88, which represent:

- fig.1, a side view of a short, smooth, upper, flexible implant for the osteosynthesis of the femoral neck;
- fig.2, a side view of a long, smooth, lower, flexible implant for the osteosynthesis of the femoral neck;
- fig.3, a view of the end of flexible implant shown in figure 1, which remains in contact with the femoral cortical shell;
- fig.4, a side view of a long, flexible implant for the osteosynthesis of femur and tibia;
- fig.5, a view of the end of flexible implant for the osteosynthesis of femur and tibia, which remains in contact with the femoral corctical shell;
- fig.6, a section through the implant, after the plane A-A, represented in figure 5;
- fig.7, a partial view of an impant for the osteosynthesis of femur and tibia achieved in another constructive version;
- fig.8, a side view with partial section of a working instrument for hammering flexible implants shown in figures 2 and 4;
- fig.9, a frontal view of the end of the instrument shown in figure 8 which is introduced in a multi-functional handle;
- fig.10, a frontal view of the active end of the instrument shown in figure 8, in which the flexible implant shown in figure 2

or figure 4 is introduced by hammering;

- fig.11, a top view of the active end of the instrument shown in figure 8, in which the flexible implant shown in figure 2 and figure 4 is introduced by hammering;

- fig.12, a view with partial section of the active end of the instrument shown in figure 8, in contact with a flexible implant shown in figure 4;

- fig.13, a side view with partial section of a working instrument for the final hammering of a flexible implant, shown in figure 4

- fig.14, a top view of the active end of the instrument shown in figure 13, coming into contact, when hammered, with the flexible implant shown in figure 4;

- fig.15, a view with section of the active end of the instrument shown in figure 13, in contact with a flexible implant shown in figure 4;

- fig.16, a side view of a working instrument with an active end for introducing or extracting in/from the bone the curvature placed near the end to be hammered of a flexible implant shown in figure 4;

- fig.17, a top view with partial section of the working instrument shown in figure 16;

- fig.18, a side view of a working instrument initially used for extracting a flexible implant shown in figure 4;

- fig.19, a top view and partial section of a working instrument shown in figure 18;

- fig.20, a side view of a working instrument, curved and sharpened, with 4 edges, for achieving the directing of a certain line into the bone in view of introducing a flexible implant shown in figure 4;

- fig.21, a section after plane B-B shown in fig.20, through the working instrument for achieving the directing of a certain line in the bone;

- fig.22, a side view of a working instrument with the round and bent end of the active end, for extracting from the bone one of the flexible implants shown in figures 1, 2 and 4;

- fig.23, a partial top view of the round and bent end of the active end of the instrument shown in figure 22;

- fig.24, a side view of a working instrument for hammering a flexible implant shown in figure 1;

- fig.25, a partial top view of the end for introducing in a multi-functional handle the working instrument shown in figure 24;

- fig.26, a frontal view of the active end of the working instrument shown in figure 24;

- fig.27, a section through the instrument, after plane C-C, shown in figure 24;

- fig.28, a partial section and view of an active end of the instrument for hammering a flexible implant, shown in figure 24, with which it comes into contact;

- fig.29, a partial section and side view of a working instrument for the final introduction of a flexible implant shown in figure 1;

- fig.3o, a top view of the instrument shown in figure 29;

- fig.31, a view in plane of an active end of the working instrument shown in figure 29, in contact with a flexible implant;

- fig.32, a partial section and side view of a working instrument for modifying the position of the end of one of the flexible implants shown in figures 1 and 2;

- fig.33, a transversal section, after plane D-D, shown in figure 32, through the instrument;

- fig.34, a partial section and side view of a working instrument for lifting from the metaphysis cortical shell the end of a flexible implant shown in figure 4;

- fig.35, a top view of the active end of the instrument shown in figure 34;

- fig.36, a side view of a drill for drilling an initial hole in the bone;

- fig.37, a side view of a working instrument for creating the impact force required for the introduction of the flexible implant in the bone;

- fig.38, a partial section and side view of a working instrument for the rotation in the bone of one of the flexible implants shown in figures 2 and 4, by means of the working instrument shown in figure 8, fastened in a multi-functional handle;

- fig.39, a frontal view of the working instrument shown in figure 38;

- fig.4o, a partial longitudinal section and view of a working instrument used for guiding a long flexible implant during its introduction in the bone;

- fig.41, a transversal section, after plane E-E, shown in figure 4o, through the working instrument;

- fig.42, a side view and partial section of a working instrument for achieving an impact required for extracting the flexible implant from the bone, by means of the instruments shown in figures 22 and 34;

- fig.43, a partial section and top view of an active end of the instrument shown in figure 42;

- fig.44, a side view and partial section of a working instrumer for introducing an upper, smooth, short, flexible implant, in the bone, over a depth of 3...4 cm;

- fig.45, a section after plane E-E, shown in figure 44, through the instrument;

- fig.46, a view of an end for fastening in the multi-functional handle of the instrument shown in figure 44;

- fig.47, a partial longitudinal section and view of an active end of the working instrument shown in figure 44, in contact with an upper, smooth, short flexible implant;

- fig.48, a frontal view of the active end of the instrument shown in figure 44, in contact with an upper, smooth, short, flexible implant transversally sectioned;

- fig.49, a side view of a working instrument for seizing and correcting the curvature of a flexible implant, shown in working position;

- fig.5o, a transversal section after plane G-G, shown in figure 49, through the instrument;

- fig.51, a top view of the working instrument shown in figure 49, with partial sections;

- fig.52, an axonometric view of the instrument shown in figure 49;

- fig.53, a partial, transversal section through the constructive detail "G" shown in figure 51;

- fig.54, a section through the instrument after plane I-I shown in figure 51;

- fig.55, a transversal section after plane J-J, shown in figure 49 through the instrument;

- fig.56, a side view of a plate in which there are mounted bolts of the working instrument shown in figure 49;

- fig.57, a section after plane K-K shown in figure 49, through the instrument;

- fig.58, an axonometric view of the working instrument shown in figure 49;

- fig.59, a transversal section after plane L-L, shown in figure 58, through the instrument;

- fig.6o, a side view of a working instrument for stiffening the long implants in case of their initial hammering or when grasping various instruments for their introduction or extraction in/from the multi-functional handle;

- fig.61, a top view of an active end of the working instrument shown in figure 6o;

- fig.62, a side view of a multi-functional handle designed to fasten various working instruments for the introduction of a flexible implant in the bone;

- fig.63, a partial longitudinal section and top view of the multi-functional handle;

- fig.64, a transversal section after plane M-M, shown in figure 63, through the multi-functional handle;

- fig.65, a frontal view of an active end of the multi-functional handle;

- fig.66, a diagram of mounting short flexible implants combined with two long flexible implants;

- fig.67, a diagram of mounting short flexible implants combined with a long flexible implant;

- fig.68, a diagram of mounting two long flexible implants spatially superposed in two points for the osteosynthesis of super and intercondylian, mediodiaphysary and subtrochanterian fractures of femur;

- fig.69, a diagram of mounting two flexible implants which are spatially superposed in only one point for the osteosynthesis of the instable fracture of the greater trochanter;

- fig.7o, a diagram of mounting from the bottom to the top two long flexible implants which are spatially superposed in two points, for the osteosynthesis of the tibia diaphysary fractures;

- fig.71, a diagram of making a hole for the introduction of a long flexible implant in the bone;

- fig.72, a diagram of achieving the prevention of buckling the long flexible implant when it is initially introduced in the bone;

- fig.73, a diagram of introducing a long flexible implant in the bone, in the first phase, with guiding, by using a working instrument shown in figure 6o;

- fig.74, a diagram of correcting, by rotation, the line of a long, flexible implant in the bone, by means of working instruments shown in figures 8, 38 and 62;

- fig.75, a diagram of the final introduction of a long, flexible implant in the bone, by means of a working instrument, shown in figure 13;

- fig.76, a diagram of mounting a long, flexible implant and of lifting it from the bone, by means of the working instrument shown in figure 16;

- fig.77, a diagram of correcting the curvature of a long, flexible implant by means of the working instruments shown in figures 16, 18 and 62;

- fig.78, a view of the working instrument shown in figure 49, placed in its working position, for curving a long flexible implant;

- fig.79, a diagram of placing the working instruments in view of extracting a long, flexible implant by means of the working instruments shown in figures 22 and 34;

- fig.80, a diagram of applying the impact force required for extracting a long, flexible implant by means of the working instruments shown in figures 22 and 42;

- fig.81, a view of the working instrument shown in figure 49, placed in working position, for modifying the curvature of the ends of short, flexible implants;

- fig.82, a diagram of initially introducing an upper, short, flexible implant in the femoral neck, by means of the working instruments shown in figures 37, 44 and 62;

- fig.83, a diagram of intermediary introduction of an upper, flexible implant in the femoral neck by means of the working instruments in figures 24, 37 and 62;

- fig.84, a diagram of final introduction of an upper, short, flexible implant in the femoral neck, by means of the working instruments shown in figures 29, 37 and 62;

- fig.85, a diagram of introducing a lower, short, flexible implant in the femoral neck by means of the instruments shown in figures 8, 37 and 62;

- fig.86, a diagram of positioning a lower, short, flexible implant in the femoral neck by means of the instruments shown in figures 8, 38, 62;

- fig.87, a diagram of final mounting of short, flexible implants in the bone;

- fig.88, a diagram of extracting short, flexible implants from the bone, by means of the working instruments shown in figures 22 and 42.

According to the present invention, the flexible implants are made up of short rods, 1 and 2, of which one is upper and the other one is lower, used in the stable flexible osteosynthesis for the fractures of the femoral neck as well as of a long rod, 3, used with another long rod, 3, in the stable flexible osteosynthesis of the diaphysary fractures of tibia, when their mounting is made from the bottom to the top, starting from the supermalleolar level on either

side of tibia, achieving their spatial superposition in two points, in the lower and upper parts of the medullary channel, or in the stable flexible osteosynthesis of the superintercondylian, diaphysary and subtrochanterian fractures of femur, in which case, the mounting of rod 3 is made by introducing it in condyle or over condyle, inside or outside, achieving a spatial superposition in the lower and upper parts of the medullary channel; in case of the instable fractures of the greater trochanter, - plain or comminuted, inter or pertrochanterian fractures -, the two rods are introduced over condyle, inside and outside, being spatially superposed in only one point, in the lower part of the medullary channel and parallel placed, in the femur neck and head.

In case of stabilizing fractures with double gap crossing the femur neck and every femoral part located under the greater trochanter, the osteosynthesis is achieved by means of both rods, 1 and 2, together with one or both rods 3.

Rod 1 is formed of an upper active part, a, with a shaped end, b, promoting the penetration and the directing, giving the possibility of choosing, when manoeuvring from the outside, the line required for stabilizing the fracture gap, continued with an upper part, c, upward curved, after which there follows a long, straight part, d, connected, through a lower part, e, downward curved, with its radius of curvature equal to that of part c, between 1 and 3 cm, to a part, f, inclined as against a horizontal direction, ended with a lug, g. The axis of part a is parallel to the axis of part f and forms an angle of 40°,..70° with the axis of part d. The latter has a lower, flat surface h, delimited by an upper surface i, whose cross-section is shaped as a truncated cone, with the small base placed toward the surface h.

Rod 2 is formed with an upper, short, straight, active part, j, with a shaped end, k, promoting the penetration and the directing, giving the possibility of choosing, when manoeuvring from the outside, the line required for stabilizing the fracture centre, connected through an upper, downward curved part, l, with a long, downward curved part, m, connected in turn, through intermediary and, respectively, lower parts, n and o, inward and outward curved, the radii of curvature having values lower than that of the curvature radius of part l, with a part, p, inclined as against a horizontal direction, ended with a lug, q. The latter has a flat lower surface, r, delimited by an upper surface with a truncated cone cross-section, s, with the small base toward surface r. The curvature radius of part m is 7 ... 10 cm, and the curvature radii of

parts n and o are 1/2 ... 1/3 (7 ... 1o) cm. The plane in which lug q is placed forms an angle of 4o°... 7o° with a horizontal plane. The axis of part j also forms an angle of 4o°... 7o° with a horizontal plane.

Rod 3 is made up of a long, straight part, t, ended with a shaped, active end, u, with an upper inclination to 45° and a lower inclination to 3o°, which makes possible, when manoeuvring from the putside, to chose the line required for stabilizing the fracture gap, connected, through some lower and, respectively, upper parts, v and w, inward and outward curved, with curvature radii having values between 3 and 5 mm, with a flat, narrow part, x, and a widened, flat or inward curved end part, y, so dimensioned as to stop the complete penetration of rod 3 in a medullary channel, not shown in the figures. Part y is delimited by part x through steps z, inclined as against the longitudinal axis of rod, 3, forming with it an acute angle of 6o°... 75°, symmetrically arranged as against the respective axis. Parts v and w are half-flattened and the width of part x is equal to those of parts v and w, with the diameter of part, t, respectively. The end u may have edges a^1, delimiting some faces converging to the longitudinal axis of rod, 3.

According to the present invention, the instrumentation is composed of an instrument 4, for introducing rods 2 and 3, an instrument 5 for final hammering of rod 3, an instrument 6, for final introduction or lifting of rod 3, in view of its extraction, an instrument 7, for lifting rod 3, in view of its extraction, an instrument 8 for achieving the adequate line of a hole b^1 in a bone 9, tibia or femur, for the introduction of rod 3 according to a certain line, an instrument 11, for hammering rods 1 and 2 in view of their introducing in bone 9, an instrument 12, for the final introduction of rod 1, an instrument 13 for modifying the curvature of the ends of rods 1 and 2, an instrument A, for guiding rod 3 when introducing it in bone 9, by hammering it, an instrument 14 for extracting parts v and w, belonging to rod 3 from bone 9, an instrument B for achieving an impact for extracting rods 1, 2 and 3 from the bone 9, an instrument C, for introducing rod 1, over a depth of 3...4 cm, an instrument D, for fastening rods 1, 2 and 3 in view of their curving depending on the needs imposed by the locating of the fracture gaps, an instrument 15, drill-shaped, a working instrument 16 for creating the impact force necessary for the introduction of rods 1, 2 and 3 in bone 9, an instrument 17, for the final introduction of rods 2

and 3 in bone 9, an instrument E for stiffening long rods 3 during their initial introduction in bone 9 and, respectively for manoeuvring instruments 4, 5, 6, 7, 8, 10, 11, 12, 13, A and B, in view of their introducing in a multi-functional handle, F, which can be rotated by means of instrument 17.

Instrument 4 is made up of a short body c^i, provided with an active end d^i having a frontal recess e^i, delimited at its bottom side by a lower wall f^i, in which an elongated seat g^i is made, communicating with a seat h^i made in a vertical wall i^i, sidewise delimiting the recess e^i. The shapes of seats g^i and h^i are so selected as to enable the penetration of part v in seat h^i, when a fragment of part t penetrates in seat g^i, and part w is placed in recess e^i. Opposite to recess e^i, body c^i has a circular collar j^i connected through a shaped part k^i with a short rod l^i. A circular seat m^i is provided in the latter. In the middle of body c^i, there is made a pierced hole n^i, with a diameter so selected as to enable the introduction of rod 3, through it.

Instrument 5 is formed of a long body o^i ended with a frontal recess p^i, delimited at its bottom side by a wall q^i and sidewise by a wall r^i. In the wall q^i there is made a seat s^i so dimensioned that, when a fragment of part t of rod 3 is introduced in it, its part v be in contact with wall r^i, and part w be positioned outside the recess p^i. Opposite to recess p^i, body o^i has a circular collar t^i, connected through a shaped part u^i with a short rod v^i. A circular seat w^i is provided in this one. In the centre of body c^i, there is made a pierced hole x^i with a diameter so selected as to enable the introduction of rod r through it.

Instrument 6 is formed of a long body y^i with two inclined faces z^i, ended with a frontal, active recess a^{ii}, so dimensioned as to enable the contact between body y^i and part v of rod 3, when no relative motion of body y^i is possible in the transversal direction, as against rod 3. Opposite to recess a^{ii}, body y^i has a circular collar b^{ii}, connected through a shaped part c^{ii} with a short rod d^{ii}. A seat e^{ii} is provided in the latter. In the centre of body y^i there is made a pierced hole, f^{ii}, with a diameter so selected as to enable the introduction of rod 3 through it.

Instrument 7 is formed of a long body g^{ii} ended with an active upward curved end h^{ii}, in which there is made an upper recess i^{ii}, so shaped as to enable the penetration of part t of rod 3, near part v. Opposite to recess i^{ii}, the body g^{ii} has a circular collar j^{ii} connected through a shaped part k^{ii}, with a short rod l^{ii}. A circu-

lar seat m^{ii} is provided in the latter. In the centre of body g^{ii}, there is made a pierced hole n^{ii}, with a diameter so selected as to enable the introduction of rod 3 through it.

Instrument 8 is made up of a body c^{ii} provided respectively with a straight, posterior part p^{ii} and a shaped, upward curved, fore part q^{ii}, ended with a sharp end r^{ii}, to which some cutting edges s^{ii} of part q^{ii} are converging. The edges s^{ii} are parallel in the first half of part q^{ii}, then they are converging to end r^{ii}. Part p^{ii} is connected through a circular collar t^{ii} and a shaped part u^{ii} with a short rod v^{ii} provided with a circular seat w^{ii}.

Instrument 10 is formed of a long, thin body x^{ii} ended with an active, hook-shaped, inward curved end y^{ii}, so shaped as to enable the gripping of part v belonging to rod 3 or the introduction of rod 1 or rod 2 in edge g. The body x^{ii} is connected through a circular collar z^{ii} and a shaped part a^{iii} with a short rod b^{iii}, provided with a circular seat c^{iii}.

Instrument 11 is made up of a body d^{iii} provided with a posterior part e^{iii}, inclined as against a horizontal plane, which is connected through a vertical part f^{iii} with a fore, horizontal flat part g^{iii}. A semi-circular seat h^{iii} is made in the latter, being so dimensioned as to be penetrated by lug g of rod 1. Part e^{iii} is connected through a circular collar i^{iii} and a shaped part j^{ii} with a short rod k^{iii} provided with a circular seat l^{iii}.

Instrument 12 is made up of a short body m^{iii}, ended with a shaped end n^{iii}, which is inclined, with an angle higher than 90^{o} as against the axis of body m^{iii}, having a diameter higher than all the rest of body m^{iii}, provided with a straight, frontal face o^{iii}. In the end n^{iii} there is made an elongated seat p^{iii}, delimited at its rear side by a wall q^{iii} of semi-circular shape, so dimensioned that when introducing lug g in it, its part f remains outside. The body m^{iii} is connected through a circular collar r^{iii} and a shaped part s^{iii} with a short rod t^{iii}, provided with a circular seat u^{iii}.

Instrument 13 is formed of a body v^{iii}, ended with a cylinder-shaped end w^{iii}, having an external diameter higher than that of body v^{iii}, in which there is made a seat x^{iii}, open to the outside, sidewise placed, having the longitudinal axis perpendicular to the longitudinal axis of body v^{ii}, in front of which there is a flat wall y^{iii}. Body v^{iii} is connected through a circular collar z^{iii} and a shaped part a^{iv} with a short rod b^{iv}, provided with a circular seat c^{iv}.

Instrument A is made up of a long body 18, to which a jaw, 2o is fastened with a nut, 19. The body 18 has a long part d^{iv}, connected through a circular collar e^{iv} and a shaped part f^{iv} with a short rod g^{iv}, provided with a circular seat h^{iv}. Opposite to collar e^{iv}, the body d^{iv} is ended with a jaw i^{iv} provided over a frontal surface j^{iv} with a semi-circular recess k^{iv}, having the longitudinal axis parallel to that of part d^{iv}. In the extension of jaw i^{iv} there is provided a short rod l^{iv} outside threaded, having the longitudinal axis placed in the extension of part d^{iv} serving for guiding jaw 2o, reason for which the latter has a pierced hole m^{iv}, through which rod l^{iv} penetrates. By fastening jaw 2o with nut 19, in front of the recess k^{iv} of jaw i^{iv} there is positioned a recess n^{iv}, having the same shape as that of recess k^{iv} from jaw i^{iv}.

Instrument 14 is made up of a thin, long body o^{iv}, ended with an active, upward curved, widened end p^{iv}, provided with two claws q^{iv} so shaped as to enable the contact with the inclined steps z of the rod 3. The body o^{iv} is delimited, through a circular collar r^{iv}, by a handle s^{iv}, provided with a longitudinally elongated window t^{iv}.

Instrument B is composed of an outside shaped handle 21, which is coupled, through a connecting piece 22, with a cylindrical active end 23, axially provided in turn with a longitudinal channel u^{iv} which communicates with the outside through a slit v^{iv} inclined as against the longitudinal axis of handle 21 with an angle of 45^{o}, the width of slit v^{iv} being equal to 1/2 of the diameter of channel u^{iv}, enabling the introduction of any of the bodies x^{ii} and o^{iv} from instruments 1o and 14. The handle 21 is provided with a spherical seat w^{iv} in which a sperical end x^{iv} of part 22 penetrates, opposite to it being a short, outside threaded rod y^{iv}, by means of which the joint with end 23 is made, reason for which a hole z^{iv} is drilled in the joint. For ensuring the threaded joint between part 22 and end 23, the pins 24 penetrating in rod y^{iv} are introduced in the end.

Instrument 15, shaped as a drill is well known and is used for making a hole with straight axis in bone 9.

Instrument 16 is formed of a tail a^{v}, provided with a longitudinally elongated window b^{v}, placed near the rear end c^{v} of the tail a^{v}. The latter forms a single piece with an active end d^{v}, having an intermediary part e^{v} shaped as a truncated cone, delimited respectively by an upper cylindrical part f^{v} and a lower, cylindrical part g^{v}, the diameter of the latter being higher than the diameter of part fv. The longitudinal axis of handle a^{v} crosses the longitudinal axis of the active end d^{v}, near part f^{v}, in order to achieve

Instrument 17 is made up of a long, cylindrical body h^{v}, ended respectively with a posterior, cylindrical collar i^{v} and a fore, cylindrical collar j^{v}, having the external diameter lower than that of collar i^{v}, frontally provided with a circular recess k^{v}, so shaped as to enable the introduction of part n of rod 2 or of part v of rod 3.

Instrument C is formed of a body 25 to which there are fastened an anvil 26 and a support 27. The anvil 26 has a short, cylindrical part l^{v}, provided with a circular recess m^{v}, and the support 27 has a threaded rod n^{v} which may be introduced/extracted in/from a L-shaped channel o^{v}, communicating with the outside, made in a band 28. In the latter, there is also worked a longitudinal channel p^{v}, ended with a circular part q^{v}, having a dimension higher than the end r^{v} which delimits at the top side the recess m^{v}, so that it is possible to displace the anvil 26 along the channel o^{v}, when the band 28 is placed in front of the recess m^{v}. The fastening of band 28 to the support 27 is made by means of nut 29 threaded on rod n^{v}. The body 25 has a straight part s^{v} on which there are fastened anvil 26 and support 27, delimited respectively by a short part t^{v}, inclined as against the longitudinal axis of part s^{v} and by part u^{v}, also inclined in the same direction as part t^{v}, as against the same axis. Part u^{v} is connected through a circular collar v^{v} and a shaped part w^{v} with a short rod x^{v}, provided with a circular seat y^{v}. The anvil 26 has a straight, upper part z^{v} connected with an inclined part a^{vi}, having the longitudinal axis parallel to that of the short part t^{v}. The part a^{vi} has an upper, inclined surface b^{vi} parallel to the longitudinal axis of part u^{v}. Band 28 is provided with a shaped, end part c^{vi}, having the shape of a circle arc in transversal section which makes with the longitudinal axis of the straight part s^{v} an angle smaller by 5^{o}... 10^{o} than the angle formed by the part t^{v} with the same axis.

Instrument D is composed of a sleeve 30 with sidewise flared edges, jointed through a short bolt 31 with a U-shaped support 32 in which there are made respectively a recess d^{vi} and some marginal, longitudinal slits e^{vi} and f^{vi}, separated from the recess d^{vi} by a wall g^{vi}. To the support 32 there is fastened a stopper 33 with which two posterior, short arms 33 may come into contact, being jointed in turn by means of a short bolt, 35 with two fore, short arms, 36. The latter are jointed with a bolt 37 to support 32, in front of the recess d^{vi}. To the bolt 37, there is also jointed a long part 38, sidewise flattened, in which there are made pierced holes h^{vi}, along the longitudinal axis. The part 38 has an external collar i^{iv},

serving for li: ting of the displacement of t sleeve 39 along it, as a result of the contact between collar i^{vi} and a lower step j^{vi} of the sleeve 39, which is sidewise cut so that it may come sidewise into contact with part 38. In the sleeve 39 there are made some pierced holes k^{vi}, having the same dimension and the same distance between them, as those of holes h^{vi}. Except holes k^{vi}, which are located along the longitudinal axis of sleeve 39, in the latter there are also disposed two holes m^{vi} on either side of the longitudinal axis, near a fore, inclined end l^{vi}.

Sleeve 39 may be closed with a plate 40 in which there are mounted thick bolts 41, which may penetrate through holes h^{vi} and k^{vi} and thin bolts, which may penetrate in holes m^{vi}. By means of bolts 41 and 42, it is possible to position one of rods 1 and 2 in view of modifying its curvature depending on the needs. For maintaining part 38 in working position, a bolt 43 is introduced in the holes n^{vi} made in the arms 34, the bolt in question being mounted, when not working, in the holes o^{vi} made in the support 32 and the lower ends p^{vi} of the arms 34 are introduced in slits e^{vi} and f^{vi}, in view of achieving a more accentuated curvature of rod 3, the arms 34 are provided with some upper recesses q^{vi} which communicate with the outside, placed at the same level when the arms 34 are brought in the working position, in which rod 3 is introduced, which is placed in this position under part 38 and sleeve 39. When removing bolt 43 and displacing upward sleeve 39 and implicitly part 38, the rod 3 is curved.

For requirements of transport and sterilization, the sleeve 39 is displaced along part 38, the ends p^{vi} of arms 34 are removed from slits e^{vi} and f^{vi}, which allows the folding of arms 34 with arms 34 and part 38 with sleeve 39 around bolt 37, so as to bring them in the perimeter delimited by support 32, a position in which they are placed under wall g^{vi}, and sleeve 39 is folded around bolt 31, being locked in its support.

The bolts 31, 35 and 37 are secured against loosening by means of nuts 44, 45 and 46. In order to prevent the displacement of the short arms 36 and part 38, during the transport, two spacing pieces 47 are also provided.

Instrument E is composed of two arms 48 and 49, jointed through a bolt 50, provided with intermediary straight parts r^{vi} and s^{vi}, continued with horizontal, posterior parts t^{vi} and u^{vi} and fore parts v^{vi} and w^{vi}, respectively, inclined as against a horizontal plane. The latter are connected with one of the shaped jaws 51 and 52, following the external shape of the flexible rod 3, serving res-

pectively for fastening rod 3 in view of its guiding during the initial introduction in bone 9 and for seizing and manoeuvring the instruments 4, 5, 6, 7, 8, 1o, 11, 12, 13, A and C for the introduction of extraction in and from the multi-functional handle.

Handle F is formed of an outside shaped body 53, provided with a longitudinal window x^{vi}, ended with a flared part y^{vi}, through which instrument 17 is introduced so as to change the position of body 53 around its longitudinal axis. The window x^{vi} is made in a middle part z^{vi} of the body 53, which is continued respectively with a posterior anvil a^{vii} and an active, cylindrical end b^{vii}. A cylindrical, longitudinal channel c^{viii} is made in the latter and it is continued with a recess d^{vii} delimited by a shaped wall e^{viii} communicating with the outside through a cylindrical seat f^{viii}. In a plane perpendicular to the plane in which there is placed channel c^{vii}, at the end b^{vii} there is made a cylindrical channel g^{vii}, having the longitudinal axis placed below that of channel c^{vii}. Channel g^{vii} communicates with the outside through the recesses h^{vii} and i^{vii}, respectively, opposite place and in this channel, a lock 54 is located, being provided with a thin, fore part j^{vii} and a thick, cylindrical, posterior part k^{vii}, in which there are made two circular channels l^{vii} and m^{vii} shifted placed as against the transversal axis of channel c^{viii}. Part j^{vii} is mounted under the action of the force stored in a spring 55 which is supported respectively on a shoulder n^{vii} which limits the recess i^{vii} and on a fore stopper 56, mounted in connection with lock 54, with the possibility of displacement in the recess i^{vii} which allows to bring, as the case may be, the thin part in front of the channel c^{viii}. The posterior stopper 57 making a single piece with lock 54 are placed in recess h^{vii} with possibility of displacement. Channel g^{vii} communicates with a channel c^{vii} placed in the same plane with channel g^{vii} placed perpendicular to the latter, in which, there is disposed, under the action of a force stored in a spring, 58, a ball, 59, which may penetrate, depending on the position of lock 54, in one of the channels l^{vii} and m^{vii}. The maintaining of the spring 58 in channel o^{vii} is made by means of screw 6o.

For introducing rods 3 in bone 9, a circular hole p^{vii} is drilled in the latter, working first with a drill-shaped instrument 15, then continued with instrument 8, so that the end r^{ii} reaches in the longitudinal axis of the medullary channel, forming the line of rod 3 penetration in it. The introduction of rod 3 in the medullary channel through hole p^{vii} is achieved by means of instrument 4, introduced in handle F. The buckling of rod 3 which may appear during

the introduction, due to the resistance of bone 9 and of blows given to handle F, by means of instrument 16 is also prevented by guiding the rod with instrument A mounted in handle F or with instrument E. Depending on the needs, rod 2 can be rotated inside the medullary channel through the instrument 4 fastened in handle F in which instrument 17 is introduced.

For the final introduction of rod 3 in the bone 9 and for bringing part y of rod 3 in contact with the external surface of the condyle, the last hammerings on the last part of introduction are made by means of instrument 5 mounted in contact with part y and then, for including part y in bone 9, the instrument 5 is brought in contact with part w or, as the case may be, by means of instrument 17.

At the end of the operation, in order to avoid an accidental side slipping, the lower part y is brough in the medullary channel by means of instrument 6 fastened in handle F until part y comes into contact with the external surface of the condyle.

Depending on the needs, rod 3 is manually curved by means of instruments 6 and 7 for which it is introduced through holes f^{ii} and n^{ii} provided in them. The curving of rod 3 may be also made by means of instrument D by introducing rod 3 in recesses q^{vii} made in arms 34 and by displacing downward sleeve 39 and, implicitly, part 38. After obtaining the fracture consolidation, for extracting rods 3 of osteosynthesis from the medullary channel, the instrument 6 is introduced between part y of rod 3 and bone 9, so that its frontal recess a^{ii} penetrates up to the part w of rod 3, creating thus the possibility that by hammering several times the handle F to which instrument 6 is fastened, parts v and w should not be fastened anymore to bone 9, after which instrument 7 is in handle F, instead of handle 6, allowing through the tilting motion, the lifting of parts v and w at the surface of bone 9. From now on, part v is brought into contact with instrument 14 and, if necessary, the part v is brought into contact with instrument 10, achieving by drawing, the extraction of rod 3 from bone 9. The total extraction of rod 3 from bone 9 is made by applying impact forces by means of instrument B on one of collars z^{ii} and r^{iv} of instruments 10 and 14. The preparation of the introduction of rods 1 and 2 in bone 9 is made by modifying the curvatures of parts e and o according to the shape of bone 9, using sleeve 39, in which rod 1 or rod 2 are introduced, and the lug g or the lug q are included in part x^{iii} of instrument 13 with which one actuates by means of the multi-functional handle F. During the operation, sleeve 39 is fastened to arms 34 through bolt 43 so as to apply the effort required for the curvature modification.

For the initial introduction of rod 1 in the neck q^{vii} of bone 9, a hole r^{vii} is drilled in bone 9, after which, by repeatedly hammering the anvil 26, belonging to instrument C, the rod 1 fastened in the latter is introduced by guiding through hole r^{vii}. The intrdduction of rod 1 in the neck q^{vii} is made by means of instrument 11, reason for which this one is assembled to handle F, on which blows are repeatedly applied with instrument 16, so that part o is directed to the inferior and internal side as against the femoral head, and the part d is directed to the superior and external side as against the femoral head, so that rod 1 may come near and parallel to the upper edge s^{vii} of the femoral neck q^{vii}.

Then, a hole t^{vii} is drilled in the bone, being located under hole r^{vii} through which rod 2 is initially introduced by means of instrument 4, in which part n of rod 2 is placed, supported by handle F, in which one introduced instrument 17 for the final introduction of body 53 in part y^{vi}, and by means of this instrument, one modifies, by rotation, the position as against the longitudinal axis, after which rod 2 is finally introduced in neck q^{vii} by repeatedly applying blows on handle F to which instrument 4 is fastened, being in contact with rod 2. In the final position, rod 2 has the part l placed in the lower side of the femoral head, the part m following a direction parallel and very near to an edge u^{vii} of the femoral neck q^{vii}.

The positioning of rods 1 and 2 related to bone 9 is achieved by means of screws 61 and 62 fastened into bone 2, so that parts f and p of rods 1 and 2 come into direct contact with the cortical shell.

The extraction of rods 1 and 2 from bone 9 is made by dismounting screws 61 and 62 and by fastening in turn rods 1 and 2, by means of instrument 10, which enables that by repeatedly applying blows with instrument B, the instrument 10 should be removed away from bone 9, which has as a result the extraction of rods 1 and 2.

For the introduction of rods 1, 2 and 3 in bone 9, proceed first to the introduction of one or both rods 3 in bone 9, up to part immediately over the fracture gap, then introduce rods 1 and 2, then continue the complete introduction of rods 1 and 2 or rod 3, the mounting stabilization being performed with screws 61 and 62 for rods 1 and 2 and by bringing part y of rod 3 in contact with the external surface of the femoral condyle.

In accordance with the present invention, the implants and the instrumentation present the following advantages:

- the flexible implants allow, through their structure enabling their use in various groups of two, three and four, the osteosynthesis of all types of femur fractures and of some tibia fractures;

- the upper and, respectively, lower short, flexible implants used for the osteosynthesis of femoral neck fractures, enable through their configuration to improve the reduction of the fracture through endoosseous taxis, do not damage the intraosseous vescular anastomoses, minimizing the incidence of later necroses of the femoral head, their fastening with orthopaedic screws to the femur diaphysis achieves a mounting with maximal stability in course of the time, the flexible characteristics of the implant to which their divergently curved shape is associated, give them the possibility of working in a dynamic couple, alternatingly creating tensions of traction, compression, which promote the biologic processes of fracture healing by accelerating them;

- the mounted long, flexible implants, which are spatially superposed in the lower and upper parts of the femur or tibia medullary channel, have the advantage that they cannot slip to the lower side due to the shape of the implant ends, preventing the perforation of the tegument and the local secondary infection, or, to the bone inside both situations causing the damage of the mounting and the fracture loss of stabilization;

- the mounted long, flexible implants which are spatially superposed in the lower side of the medullary channel and parallel in the femoral neck have the advantage of stabilizing the instable fractures of the greater trochanter, the tensions which tend to displace the fracture being taken over through the implants and spread over the two side faces of the femur lower side as well as the slipping toward the lower side, preventing the perforation of the tegument and the local secondary infection;

- the combined use of the short and long implants in the double gap fractures of the femoral neck of any other part of the femur have the advantage of preserving the flexibility of the mounting in the fracture areas and all over the bone line when performing fast surgical operations which are less injuring for the patient;

- they enable simple and easy manoeuvres for the introduction/extraction of the flexible implants from/in the bone;

- they have a simple construction and a great reliability;

- they may be easily cleaned and sterilized and do not have areas of collecting organic remnants resulted during the operation;

- they may be handled with the same multi-functional handle;

- with a small number of instruments and relatively small dimensions, one ensures the achievement of the osteosynthesis of a wide fracture range;

- the handling, transport and preparation for operation may be made without difficulty.

C L A I M S

1.Flexible implants for the stable flexible osteosynthesis of the femur and tibia fractures, which, under the conditions of the femural fracture placing in the mediodiaphysary and femoral neck are, two of them, introduced through the medullary channel in the femur, condylian or overcondylian, outside or inside placed, both being so curved as to be superposed in the space in two points, in the lower and upper parts of the medullary channel, another one is introduced according to a direction parallel to the upper edge of the femoral neck coming in its immediate vicinity, and the last one is placed in the lower channel of the femoral neck, following a direction parallel and very near to the edge of the femoral neck, under those of the femur fracture placing in the femoral neck and subtrochanterian zones, one is introduced through the medullary channel into the femur, condylian or overcondylian, outside or inside, having finally a curved shaped, another one is introduced, according to a direction parallel to the upper edge of the femoral neck, coming to its immediate vicinity, and the last one is placed in the lower quadrant of the femoral neck. following a direction parallel and very near to the edge of the femoral neck, under those of femur fracture placing in the mediodiaphysary, subtrochanterian, super and intercondylian zones, two of them are introduced through the medullary channel into the femur, condylian or supercondylian, outside or inside, both being so curved as to finally superpose in the space in two points, in the lower and upper parts of the medullary channel and under those of the femur fracture placing only in the zone of the greater trochanter, two of the implants are introduced through the medullary channel into the femur, condylian and supercondylian, outside or inside, both being so curved as to finally superpose spatially in the lower part, in only one point, after which they follow some parallel lines in the medullary channel, under those of fracture placing only in the zone of the femoral neck, one of them is introduced according to a direction parallel to the upper edge of the femoral neck coming in its vicinity, and another one is placed in the lower quadrant of the femoral neck, following a direction parallel and very near to the edge of the femoral neck and finally under those of tibia fracture placing in the diaphysary areas, two of the implants are introduced

through the medullary channel from the bottom to the top, starting from the supermalleolar level, on either side of tibia, both being so curved as to be finally superposed in space, in two points, in the lower and upper parts of the medullary channel, c h a r a c t e r i z e d b y t h e f a c t t h a t, in order to achieve osteosyntheses stabilizing the fracture gaps, enabling the patients' recovery in a short period, they are made of short rods (1 and 2), one upper and one lower, used in the osteosynthesis for the fractures of the femoral neck, as well as of a long rod (3), used as such or with another long rod (3) and with the short rods (1 and 2) in case of stabilizing the double gap fractures crossing the femur neck and every part of the femur placed under the greater trochanter, or only with another long rod (3) for stabilizing the diaphysary fractures of tibia and femur and, respectively, the super and intercondylian fractures of femur, the upper short rod (1) being made up of an upper, active part (a) having a shaped end (b), continued with an upper, upward curved part (c), after which there follows a long, straight part (d), connected through a lower, curved part (e), downward directed, with a part (f), inclined as against a horizontal direction, ended with a lug (g), the lower short rod (2) being formed of an upper, short, straight active part (j) with a shaped end (k), connected through an upper, downward curved part (l) with a long, downward curved part (m), in turn connected by means of intermediary and lower parts (n and o), inward and respectively outward connected, with a part (p) inclined as against a horizontal direction, ended with a lug (q), the long rod (3) being made up of a long, straight part (t), ended with a shaped end (u), promoting the penetration and the directing in the bone (9), connected through lower and upper parts (v and w), inward and respectively outward curved, with a flat, narrow part (x) and a flat or inward curved, widened end part (y), so dimensioned that it stops the complete penetration of the long rod (3) in the medullary channel.

2. Implants according to claim 1, c h a r a c t e r i z e d b y t h e f a c t that the upper, short rod (1) has in its lower downward curved part (e) a radius of curvature which is equal to that of the upper, upward curved part (c) between 1 and 3 cm, and the axis of the upper active part (a) is parallel to the axis of the part (j), inclined as against a horizontal direction and forms with the axis of the long, straight part (d) an angle of $40^{\circ}...70^{\circ}$, the long, straight part (d) having a lower, flat surface (h) delimited by an upper surface with the shape of a truncated cone in cross-section, with the small base placed to the flat, lower surface (h).

3.Implants according to claim 1, c h a r a c t e r i z e d b y t h e f a c t that the lower, short rod (2) has in its long, downward curved part (m) a radius of curvature between 7 and 10 cm, and the radii of curvature of the intermediary and, respectively, lower, inward and, respectively, outward parts (n and o) are equal to each other and have values between 1/2 - 1/3 of the curvature radius of the long, downward curved part (m), these radii being lower than the curvature radius of the upper, downward curved part (l), the plane in which there is placed the lug (c), which has a flat, lower surface (r), delimited by a surface (s) with the shape of a truncated cone and the small base placed toward the lower surface (r), forming with a horizontal plane an angle of 40^{o} ... 70^{o}, and the axis of the upper, short, straight, active part (j) forms an angle of 40^{o} ... 70^{o} with a horizontal plane.

4.Implants, according to claim 1, c h a r a c t e r i z e d b y t h e f a c t that the long rod (3) has the active shaped end (u) provided with an upper inclination up to 45^{o} and a lower inclination up to 30^{o} or with some edges (a^{1}) delimiting some faces converging to the longitudinal axis of the long rod (3), the lower and, respectively, upper parts (v and w), inward and, respectively outward curved, having curvature radii with values between 3 and 5 mm, and the end part (y) is delimited by the flat, narrow part (x), by some steps (z), inclined as against the longitudinal axis of the long rod (3) forming with it an acute angle of 60^{o} ... 75^{o}, symmetrically disposed as against the vertical axis, the lower and, respectively upper parts (v and w), inward and, respectively outward curved being semi-flattened, the widths of these parts (v and w) being equal respectively to the width of the flat, narrow part (x) and to the diameter of the long, straight part (t).

5.Working instrumentation required for achieving an efficient surgical operation in the stable flexible osteosynthesis of the fractures of femoral neck, the fractures of the greater trochanter, the subtrochanterian, mediodiaphysary, super and intercondylian fractures of femur, as well as the diaphysary fractures of tibia, when the stabilizing of the fracture gap is achieved by means of flexible implants according to claims 1 ... 4, which includes a drill-shaped instrument for making, in the bone, a hole, whose axis is perpendicular to the longitudinal axis of the bone, an instrument for achieving the adequate lines for the introduction of a long rod in the bone, a working instrument for creating the impact force necessary for introducing any of the flexible rods in the bone, an instrument for stiffening the

long rods when they are initially introduced in the bone, an instrument for the final hammering of the long rod, an instrument for the final introduction or the lifting in view of withdrawal of the long rod in/from the bone, an instrument for hammering the short, upper and, respectively, lower rods, in view of their introduction in the bone, an instrument for changing the curvature of the ends of the said short rods, an instrument for extracting either the long rod or the short rods from the bone, an instrument for releasing the end parts of the long rod from the bone, an instrument for achieving an impact, in view of extracting either the long rod or the short rods from the bone, c h a r a c t e r i z e d b y t h e f a c t t h a t in order to stabilize the fracture gaps in the above said cases, when making less injuring surgical operation, with minimal blood losses, for introducing both the long rod (3) through the hole (b^i) made in the bone (9) and the said short, lower rod (2), through another hole (t^{vii}) made in the bone (9), it is composed of an instrument (4) which is made up of a short body (c^i) provided with an active end (d^i) with a frontal recess (e^i), delimited at the bottom side by a lower wall (f^i), in which there is made an elongated seat (g^i) communicating with a seat (h^i) made in a vertical wall (i^i), sidewise delimiting the recess (e^i), the shapes of seats (g^i and h^i) being so selected as to allow the penetration of the lower, inward curved part (v) of the long rod (3) in the seat (h^i) made in the wall (i^{ii}), when a fragment of the long, straight part (t) of the long rod (3) penetrates in the elongated seat (g^i), and the upper, outward curved part (w) of the respective rod (3) is placed in the frontal recess (e^i), opposite to which, the body (c^i) having a circular collar (j^i) connected, through a shaped part (k^i), with a short rod (l^i), the latter being provided with a central circular seat (m^i), a pierced hole (n^i) being made in the body (c^i), its diameter being so selected as to enable the introduction of the long, straight part (t) of the long rod (3), through it, in view of correcting the curvature, for which the rod (3) is also introduced through another pierced hole (n^{ii}), drilled in a long body (g^{ii}) of an instrument (7) for lifting the long rod (3) in view of extracting from the bone (9), the body (g^{ii}) being ended with an active, upward curved end (h^{ii}), in which an upper recess (i^{ii}) is made, being so shaped as to enable the penetration of the straight, long part (t) of the long rod (3), near the lower, inward curved part (v) of the long rod (3), opposite to the upper recess (i^{ii}), the body (g^{ii}) having a circular collar (j^{ii}), connected through a shaped part (k^{ii}) with a short rod (l^{ii}) in which there

is made a circular hole (m^{ii}), for the initial introduction of the upper, short rod (1) over a depth of 3...4 cm, in the hole (r^{vii}) made in the bone (9), using an instrument (C) composed of a body (25) to which there are fastened an anvil (26) and a support (27), the anvil (26) having a short, cylindrical part (l^{ii}), provided with a circular recess (m^{v}) and the support (27) has a threaded rod (n^{v}), which may be respectively introduced/extracted in/from a L-shaped channel (o^{v}), communicating with the outside, made in a band (28), in the latter being also made a longitudinal channel (p^{v}), ended with a circular part (q^{v}), having a dimension higher than that of an end (r^{v}) delimiting at the top side the circular recess (m^{v}) so that it is possible to displace the anvil (26) along the channel (p^{v}), when band (28) is located in front of the recess (m^{v}), the fastening of the band (28) to the support (27) being achieved by means of a nut (29) threaded on rod (n^{v}), the body (25) having a straight part (s^{v}) to which there are fastened the anvil (26) and the support (27), delimited by a short part (t^{v}), inclined as against the longitudinal, straight part (s^{v}) and, respectively by a part (u^{v}) also inclined in the same direction as the short part (t^{v}), as against this axis, the inclined part (u^{v}) being connected through a circular collar (v^{v}) and a shaped part (w^{v}) with a short rod (x^{v}), provided with a circular seat (y^{v}), the anvil (26) having an upper, straight part (z^{v}), connected with an inclined part (a^{vi}), with the longitudinal axis parallel to that of the short part (t^{v}), provided with an upper, inclined surface (b^{vi}), parallel to the longirudinal axis of the inclined part (u^{v}), the band (28) being provided with a shaped end part (c^{vi}), having, in transversal section, the shape of a circle arc making with the longitudinal axis of the straight part (s^{v}) and angle lower by 5 ... 10^{o} than the angle formed by the part (t^{v}) with the same axis, the final positioning of the upper, short rod (1) in the neck (g^{vii}) being made by means of an instrument (12), which is made up of a short body (m^{iii}), ended with a shaped end (n^{iii}), inclined with an angle higher than 90^{o} as against the axis of body (m^{iii}) and with a diameter higher than the rest of the body (m^{iii}), provided with a straight, frontal face (o^{iii}), in the shaped end (n^{iii}) being made an elongated seat (p^{iii}), delimited at the bottom side by a semi-circular wall (g^{iii}) so dimensioned that, when introducing the lug (g) of the upper, short rod (1) in it, its part (f) inclined as against a horizontal direction remains outside, the body (m^{iii}) being connected through a circular collar (r^{iii}) and a shaped part (s^{iii}) with a short rod (t^{iii}), provided with a circular seat (u^{iii}), a handle (F) being used for the

introduction or extraction of the short and, respectively long rods (1, 2 and 3) in/from the bone (9), enabling during the operation to fasten the instrument (4) for the introduction of the short, lower and respectively long rods (2 and 3), of an instrument (5) for the final hammering of the said long rod, of an instrument (6) for the final introduction or for lifting in view of extracting the long rod (3) in/from the bone (9), of an instrument (7) for lifting in view of extracting the long rod (3), of an instrument (7) for achieving the adequate line of introducing the long rod (3) in the bone (9), of an instrument (10) for extracting from the bone (9) any of the short and, respectively long rods (1, 2 and 3), of an instrument (11) for hammering the short rods (1 and 2), in view of their introducing in the bone (9), of an instrument (12) for the final introduction of the short, upper rod (1), of an instrument (13) for modifying the curvature of the ends of short rods (1 and 2), of an instrument (14) for extracting the long rod (3) from the bone (9) and, respectively, of an instrument (C) for introducing the short, upper rod (1) over a depth of 3-4 cm, the handle (F) being able to be rotated during the operation for positioning the rod (3) in the medullary channel or the lower, short rod (2) in the neck (q^{vii}), by means of an instrument (17), which is made up of a long, cylindrical body (h), ended respectively with a posterior, cylindrical collar (i^{v}) and a fore, cylindrical collar (j^{v}), having a diameter lower than that of collar (i^{v}), frontally provided with a circular recess (k^{v}), so shaped as to enable the introduction of the intermediary part (n) of the lower, short rod (2) or the lower, inward curved part (v) of the long rod (3).

6. Instrumentation, according to claim 5, c h a r a c t e r i z e d b y t h e f a c t that the handle (F) is formed of an outside shaped body (52), provided with a longitudinal window (x^{vi}) ended with a flared part (y^{vi}), the window (x^{vi}) being made in a middle part (z^{vi}) of the body (53), which is continued respectively with a posterior anvil (a^{vii}) and an active, cylindrical end (b^{vii}) in which there is made a cylindrical, longitudinal channel (c^{viii}), continued with a recess (d^{iii}) delimited by a shaped wall (e^{vii}) communicating with the outside through a cylindrical seat (f^{vii}), in a plane perpendicular to the plane in which there is placed channel (c^{vii}), in whose active end (b^{vii}) there is made a cylindrical channel (g^{vii}), having the longitudinal axis placed under that of the longitudinal channel (c^{vii}), communicating with the outside through recesses (h^{vii} and i^{vii}) opposed placed, in which there is placed a lock (54), provided with a fore, thin part (j^{vii}) and a thick, cylindrical, posterior part (k^{vii}) in which there are made two circular channels (l^{vii}

and m^{vii}) shifted placed as against the transversal axis of the longitudinal, cylindrical channel (c^{vii}), the fore part (j^{vii}) being mounted under the action of the force stored in a spring (55), which is suppoerted respectively on a shoulder (n^{vii}) limiting the recess (i^{vii}) and on a fore stopper (56), mounted in connection with the lock (54), having the possibility to displace in the recess (i^{vii}), which enables to bring, as the case may be, the thin part (j^{vii}) in front of the cylindrical, longitudinal channel (c^{vii}) in the other recess (h^{iii}) a posterior stopper (57) being placed, with the possibility to displace and forming a single piece with the lock (54), the cylindrical channel (g^{vii}) communicating with a channel (e^{vii}) placed in the same place with channel (g^{vii}) and perpendicular to the latter, in which, under the action of a force stored in a spring (58), a ball (59) is placed which may penetrate, depending on the position of lock (54), in one of the channels (l^{vii} and m^{vii}), the maintaining of the spring (58) in the last said channel (o^{vii}) being achieved by means of a screw (6o), the rotation of handle (F) around the longitudinal axis, depending on needs, when introducing the short, lower rod (2) or the long rod (3) in the bone (9) being made by means of the said instrument (17), for the final introduction of the mentioned short rods (2 and 3) into the bone (9), reason for which it is introduced in the flared part (y^{vi}) of the longitudinal window (x^{vi}), all instruments (4, 5, 6, 7, 8, 1o, 11, 12, 13, 14 and C), which are manoeuvred by means of handle (F), having each one of the collars (j^{i}, t^{i}, b^{ii}, j^{ii}, t^{ii}, z^{ii}, i^{iii}, x^{ii}, z^{iii}, x^{iii} and v^{v}), connected through one of the shaped parts (k^{i}, u^{i}, c^{ii}, k^{ii}, u^{ii}, a^{iii}, j^{iii}, s^{iii}, a^{iv}, s^{iv} and w^{v}), with one of the short rods (l^{i}, v^{i}, d^{ii}, l^{ii}, v^{ii}, b^{iii}, k^{iii}, t^{iii}, b^{iv}, t^{iv} and x^{v}), provided with one of the circular seats (m, w, e^{ii}, m^{ii}, w^{ii}, c^{iii}, l^{iii}, u^{iii} and y^{v}) which enables their locking by means of lock (54).

7. Instrumentation according to claims 5 and 6 c h a r a c t e r i z e d b y t h e f a c t that for guiding the long rod (3) during its initial introduction in the bone (9), in other constructive version, it includes an instrument (A), fastened in handle (F), made up of a long body (18), to which there is fastened a jaw (2o), by means of a nut (19), the body (18) having a long part (d^{iv}), connected through a circular collar (e^{iv}) and a shaped part (f^{iv}) with a short rod (g^{iv}), provided with a circular seat (b^{iv}), opposed to the collar (e^{iv}), the body (d^{iv}) being provided with a jaw (i^{iv}) provided on the frontal surface (j^{iv}), with a semi-circular recess (k) heving the longitudinal axis parallel to that of the long part (d^{iv})

in the extension of jaw (i^{iv}), a short rod (l^{iv}) outside threaded and a longitudinal axis in the extension of the long part (d^{iv}), serving for guiding the jaw (2o), reason for which the latter has a pierced hole (m^{iv}), through which the rod (e^{iv} penetrates, a recess (n^{iv}) having the same shape as the semi-circular recess (k^{iv}), being positioned in front of the recess (k^{iv}) of the jaw (i^{iv}), ba fastening jaw (2o), reason for which the latter has a pierced hole (m^{iv}), through which the rod (e^{iv}) penetrates, a recess (n^{iv}) having the same shape as the semi-circular recess (k^{iv}) being positioned in front of the recess (k^{iv}) of the jaw (i^{iv}), by fastening jaw (2o) with nut (19).

8.Instrumentation according to claims 5, 6, and 7 c h a r a c t e r i z e d b y t h e f a c t that, for modifying the curvatures from the lower, downward curved and, respectively, lower, outward curved parts (e and o) of the short, upper and, respectively lower rods (1 and 2) and from the straight, long part (t) of the long rod (3), depending on the bone shape (9), in other constructive version, it includes an instrument (D), composed of a sleeve (3o) with sidewise flared edges, jointed by means of a short bolt (31) with a U-shaped support (32), in which there are made respectively a recess (d^{vi}) and some longitudinal, marginal slits (e^{vi} and f^{vi}), separated from the recess (d^{vi}) by a wall (g^{vi}), a stopper (33) being fastened to the support (32) and coming in contact with two posterior, short arms (34), jointed in turn by means of a short bolt (35) with two fore, short arms (36), the latter being jointed through a bolt (37) to the support (32), in front of the recess (d^{vi}) being also jointed through this bolt (37) a long, sidewise flattened part (38), in which there are made, along its longitudinal axis, some pierced holes (h^{vi}), the long part (38) having an outer, circular collar (i^{vi}), serving for limiting the displacing of a sleeve (39), along it, as a result of the contact between the collar (i^{vi}) and a lower step (j^{vi}) of the sleeve (39) which is sidewise cut out, so that it may come in contact sidewise with part (38) in the sleeve being (39) being made some pierced holes (k^{vi}) with the same diameter and the same distance between them as those of the other holes (h^{vi}), except these latter said holes (k^{vi}) which are placed along the longitudinal axis of sleeve (39), in the latter being also provided two holes (m^{vi}) disposed on either side of the longitudinal axis, near a fore inclined end (l^{vi}) the sleeve (39) being able to be closed with a plate (4o), in which there are mounted thick bolts (41), which may penetrate through the holes (h^{vi} and k^{vi}) and, respectively, thin bolts (42) which may pene-

trate in the two holes (m^{vi}), in view of achieving a more accentuated curvature of the long part (t) of the long rod (3), the posterior arms (34) being provided with some upper recesses (q^{vi}), communicating with the outside, placed at the same level when the respective arms (34) are brought in working position, in which the long rod (3) is introduced, the respective rod in this position being placed under the long part (38) and the sleeve (39) and, implicitly, the part (38), the long rod being curved, the modification of the curvatures (e and o) of the short rod (1 and 2), according to the shape of the bone (9), being made by means of sleeve (39) and bolts (41, 42) between which there are introduced the short rods (1 and 2), as the case may be, with the maintaining of part (38) in working position, a bolt (43) being mounted when not working, in the holes (o^{vi}), drilled in the support (32) and the lower ends (p^{vi}) of the arms (34) being introduced in the slits (e and f) and finally, for transport and sterilization requirements, the sleeve (39) and the arms (34) and, respectively, the long part (38) are rotated around bolt (37), so as to bring them in the perimeter delimited by the support (32), position in which they are placed under the wall (g^{vi}), the sleeve (39) being revolved around the bolt (31), being locked in the support (30), the bolts (31, 35 and 37) being secured against loosening nuts (44, 45 and 46), in order to prevent the displacement of the component parts during the transport, namely the short arms (36) and the part (38), two spacing pieces (47) being provided.

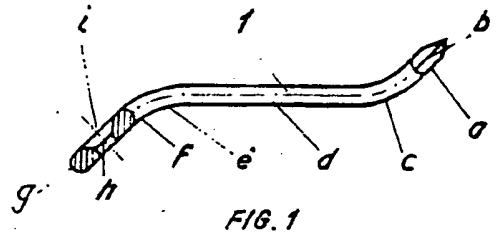

FIG. 1

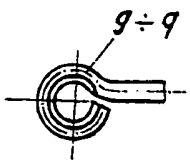

FIG. 3

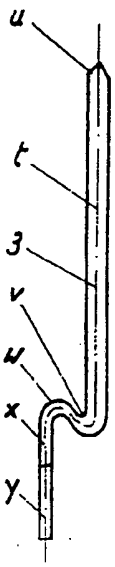

FIG. 4

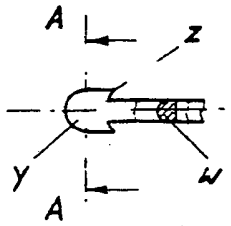

FIG. 5

FIG. 6

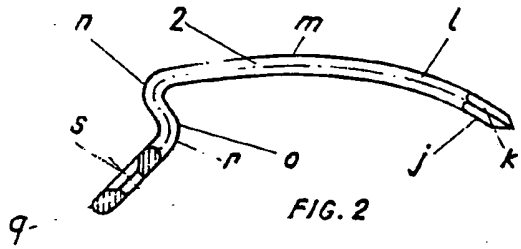

FIG. 2

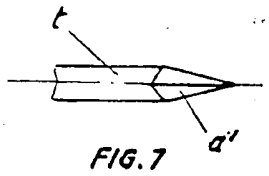

FIG. 7

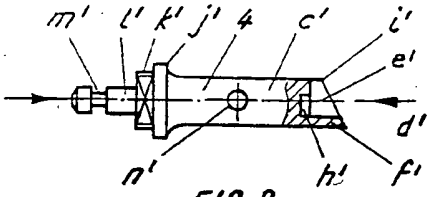

FIG. 8

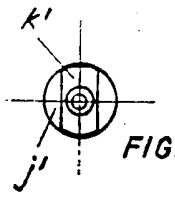

FIG. 9

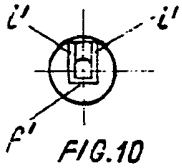

FIG. 10

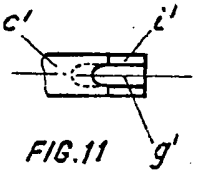

FIG. 11

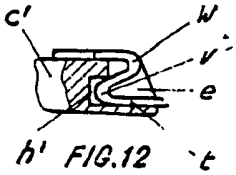

FIG. 12

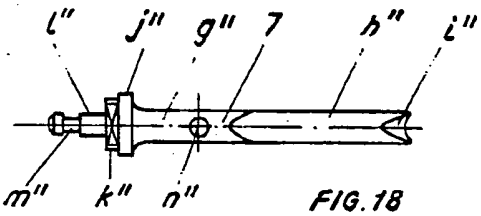

FIG. 18

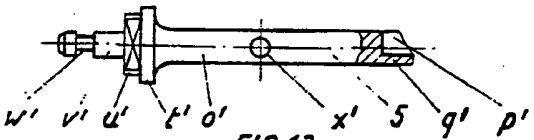

FIG. 13

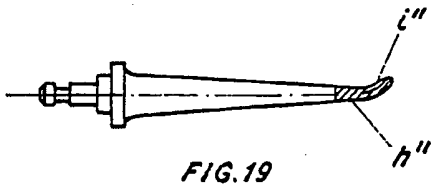

FIG. 19

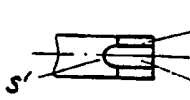

FIG. 14

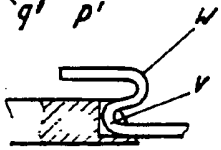

FIG. 15

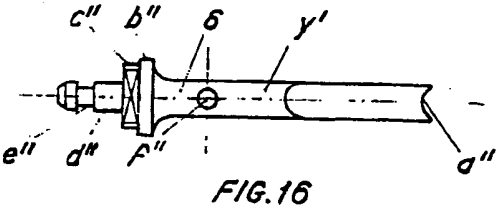

FIG. 16

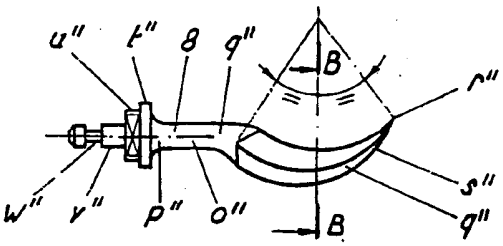

FIG. 20

FIG. 17

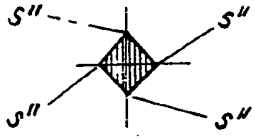

FIG. 21

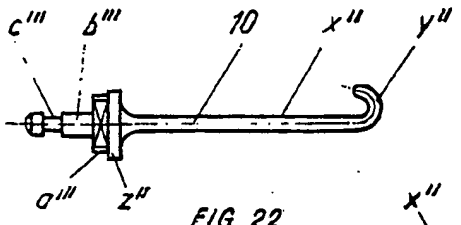

FIG. 22

FIG. 23

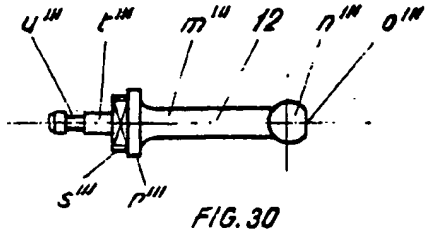

FIG. 30

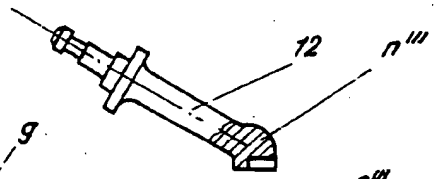

FIG. 29

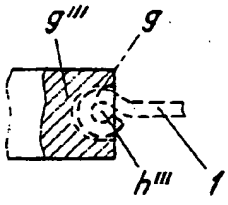

FIG. 28

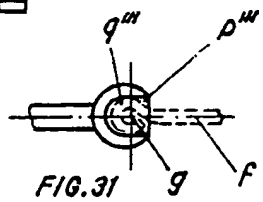

FIG. 31

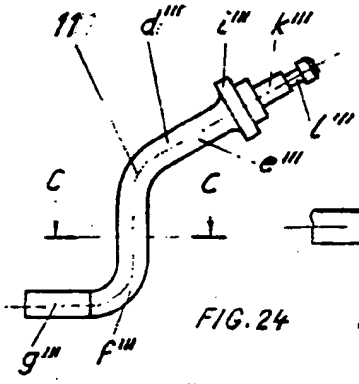

FIG. 24

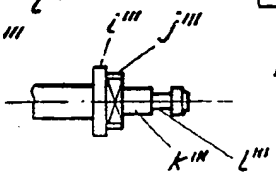

FIG. 25

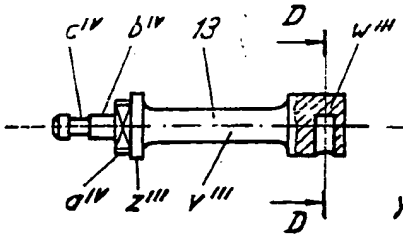

FIG. 32

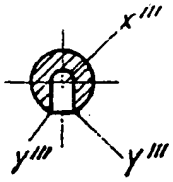

FIG. 33

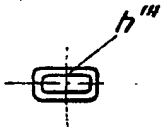

FIG. 26

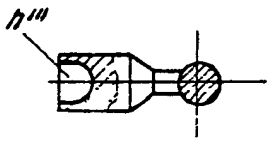

FIG. 27

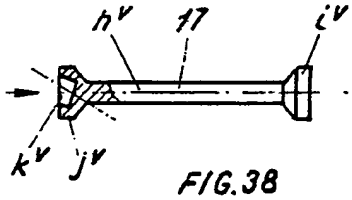

FIG. 38

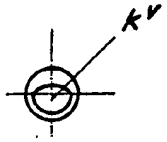

FIG. 39

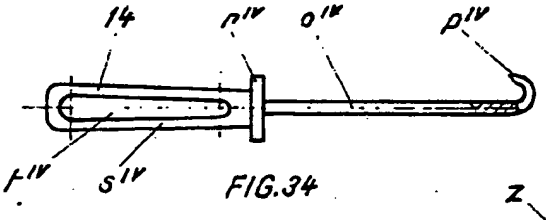

FIG. 34

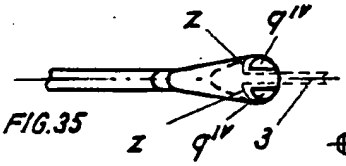

FIG. 35

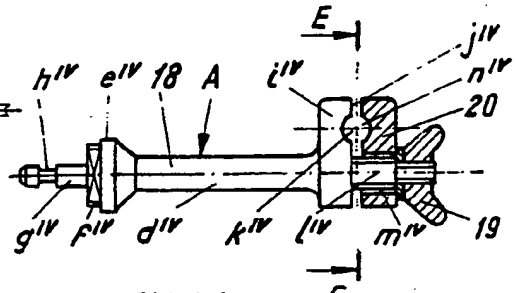

FIG. 40

FIG. 36

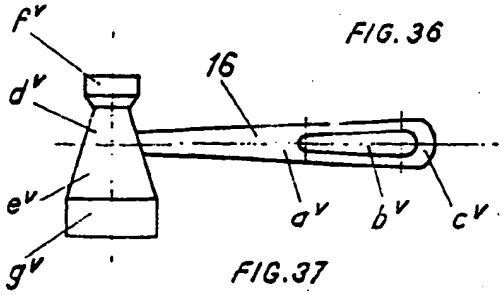

FIG. 37

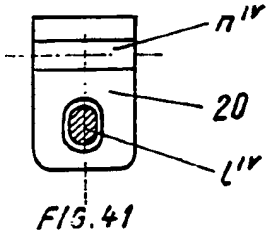

FIG. 41

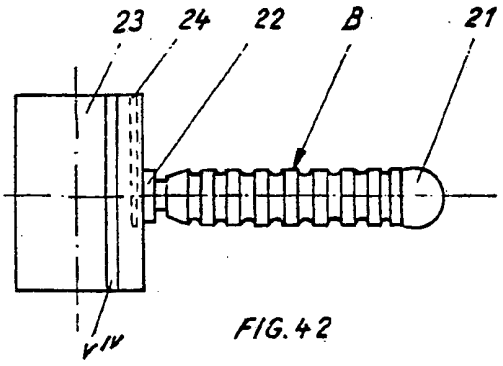

FIG. 42

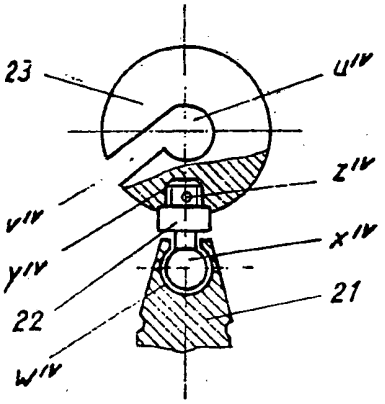

FIG. 43

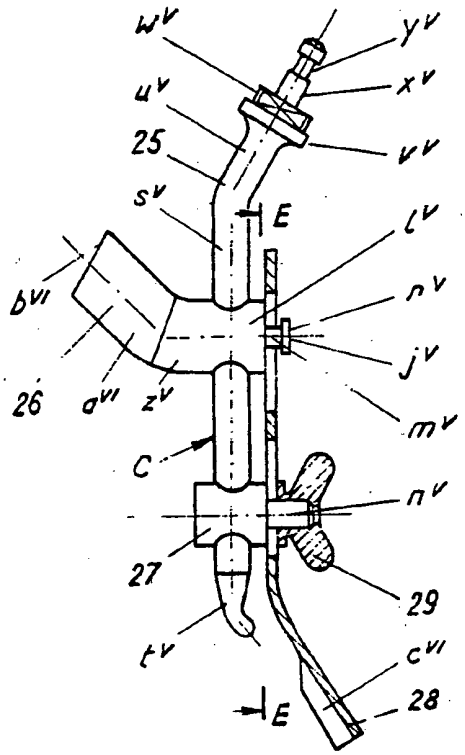

FIG. 44

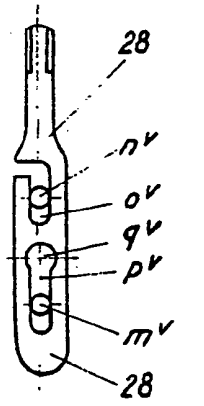

FIG. 45

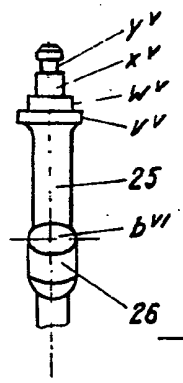

FIG. 46

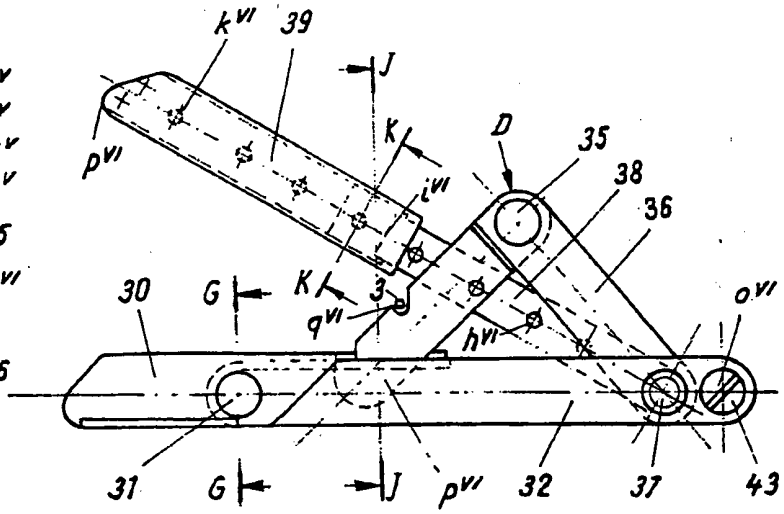

FIG. 49

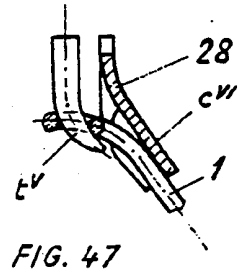

FIG. 47

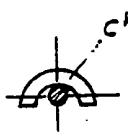

FIG. 48

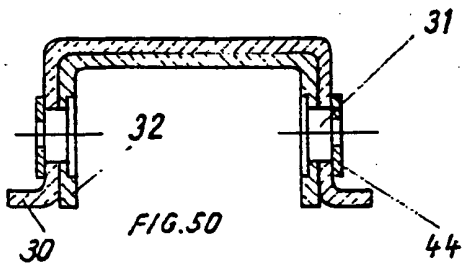

FIG. 50

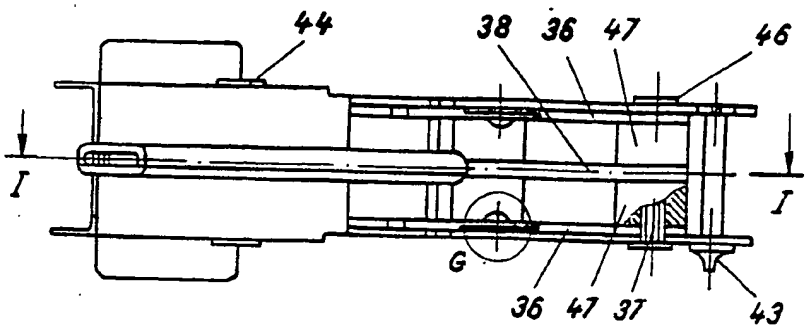

FIG.51

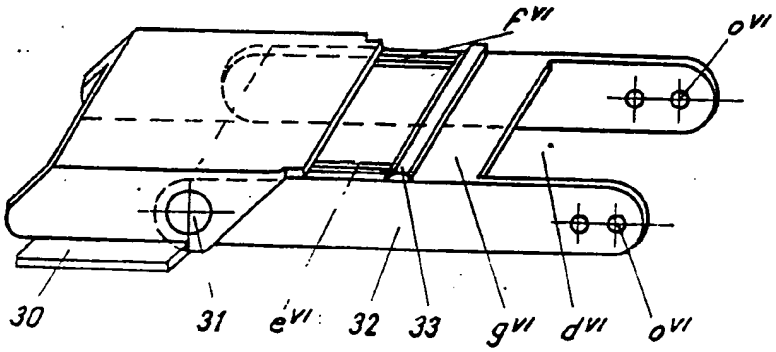

FIG.52

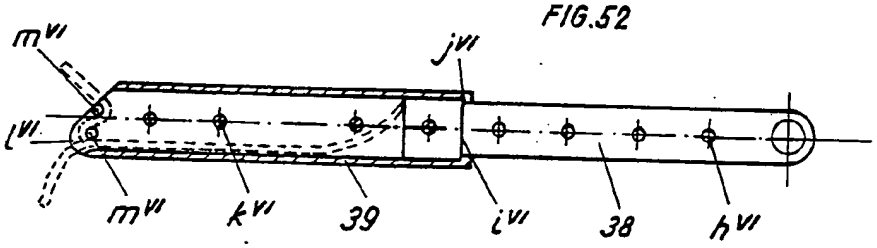

FIG.54

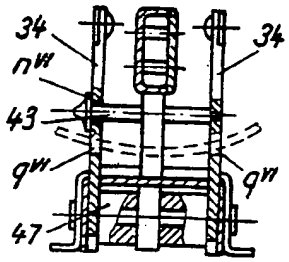

FIG.55

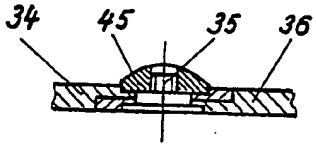

FIG.53

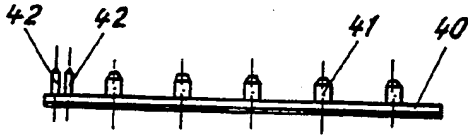

FIG.56

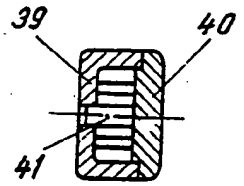

FIG.57

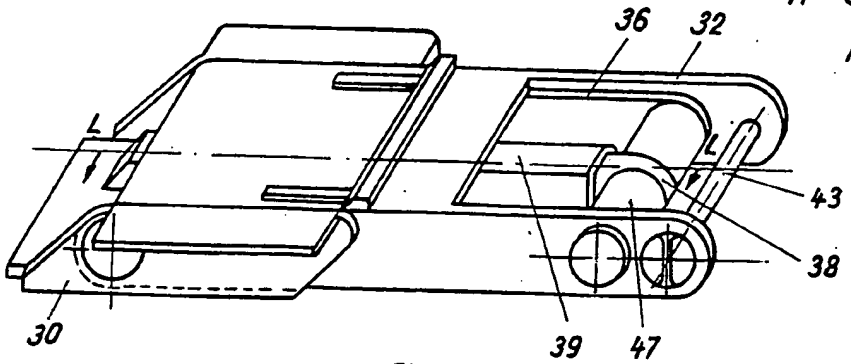

FIG.58

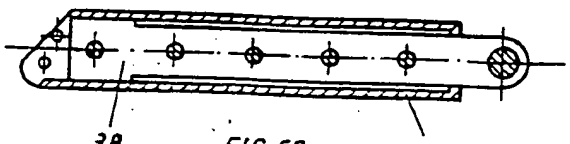

FIG.59

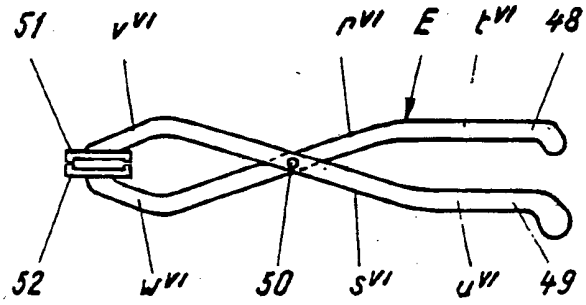

FIG.60

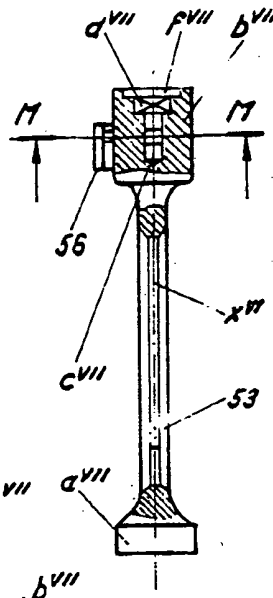

FIG.63

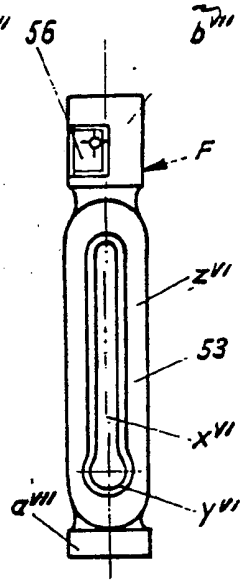

FIG.62

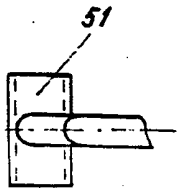

FIG.61

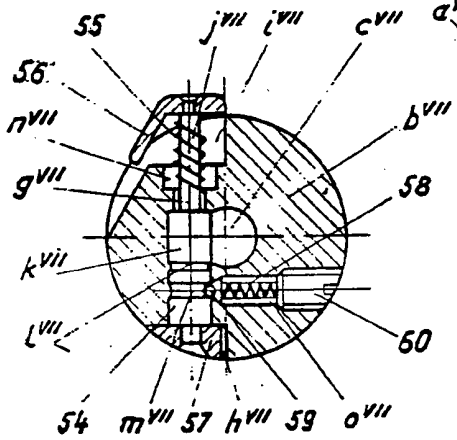

FIG.64

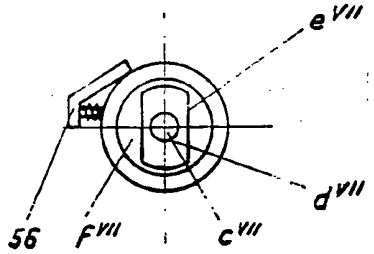

FIG.65

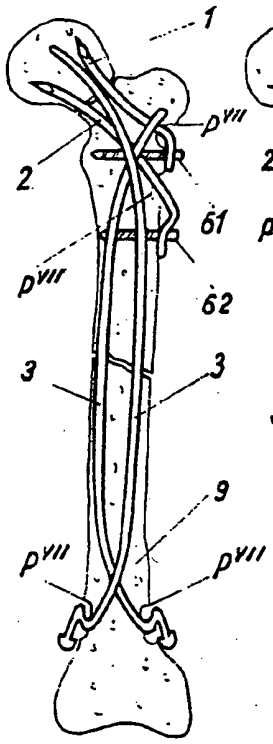

FIG.66

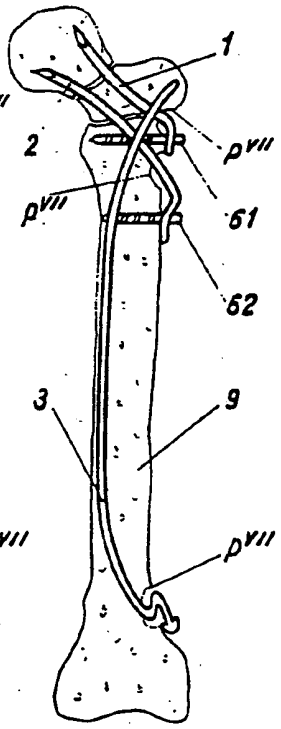

FIG.67

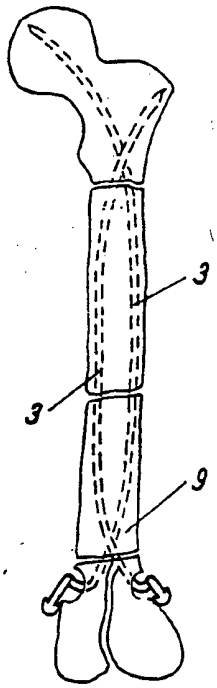

FIG.68

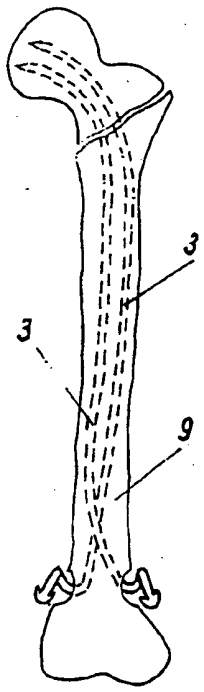

FIG.69

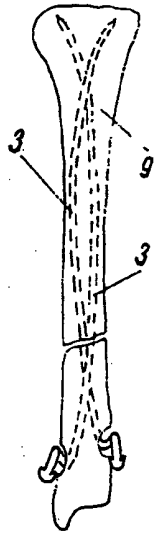

FIG.70

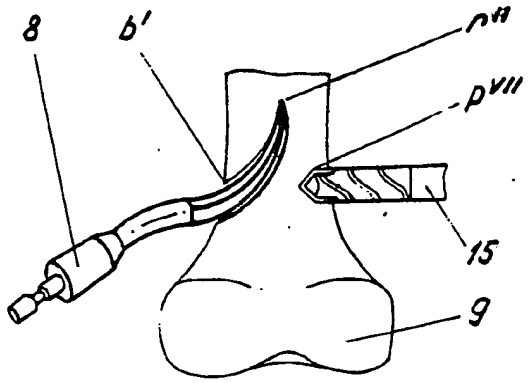

FIG. 71

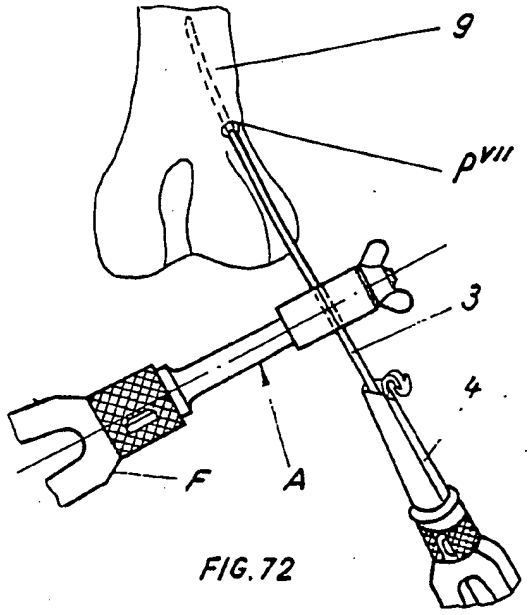

FIG. 72

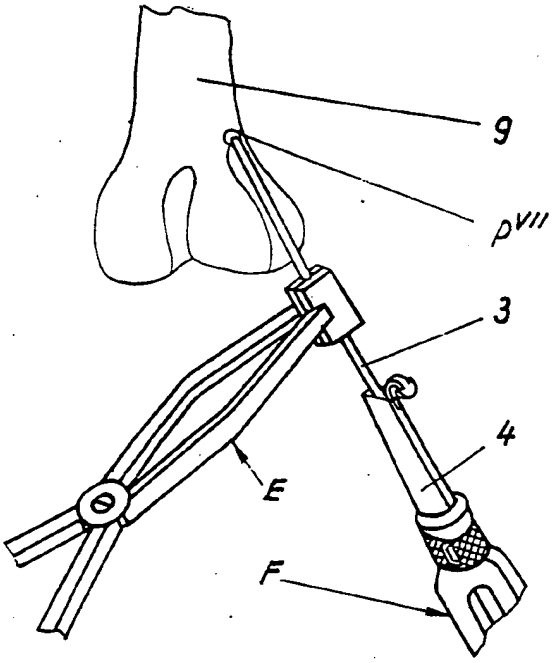

FIG. 73

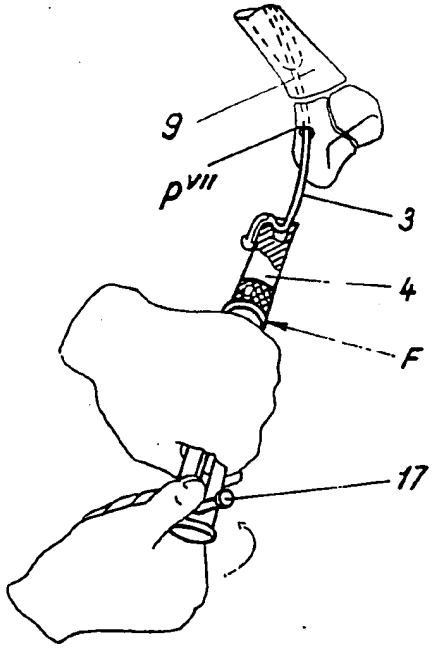

FIG. 74

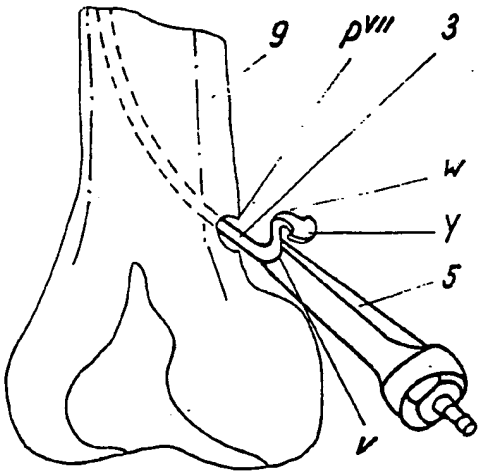

FIG. 75

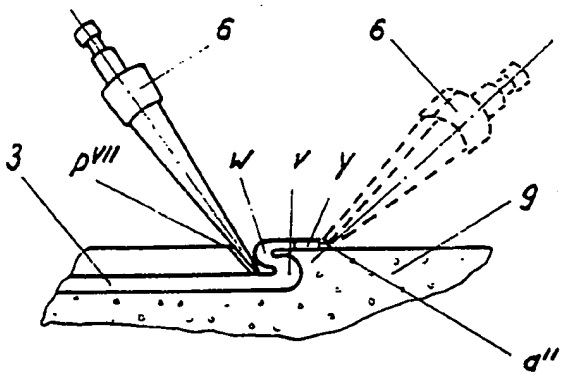

FIG. 76

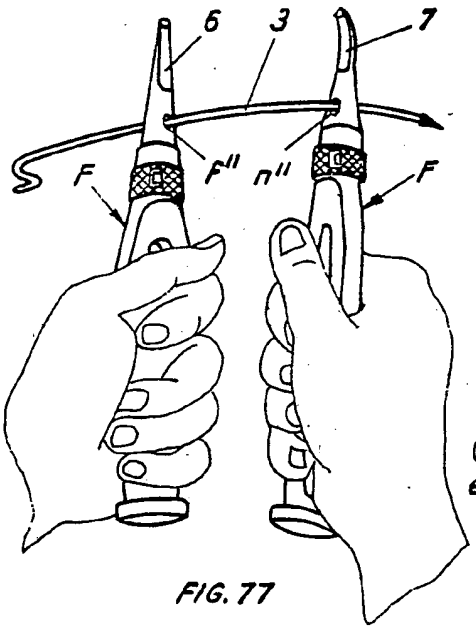

FIG. 77

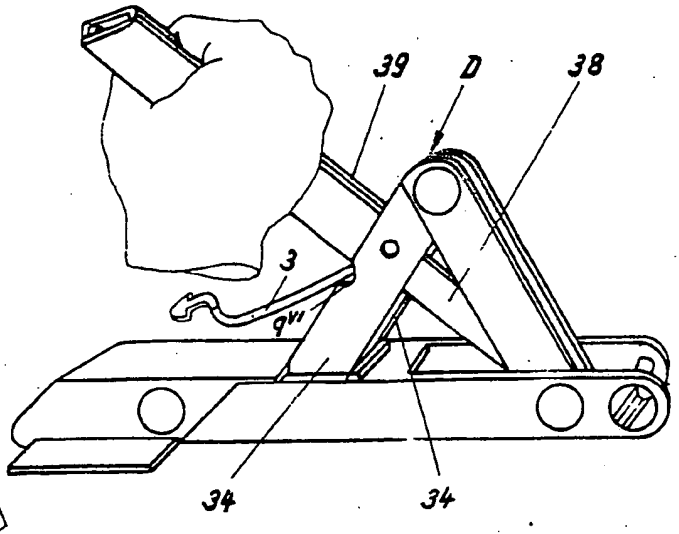

FIG. 78

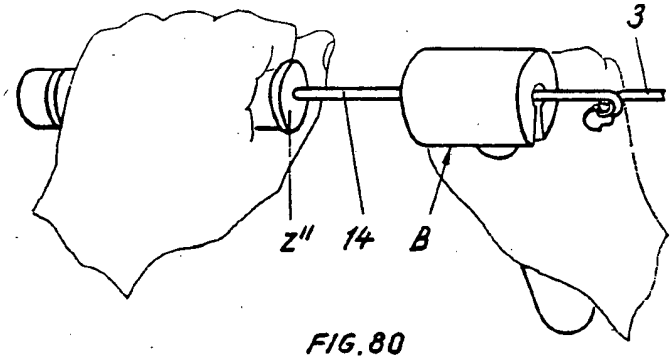

FIG. 80

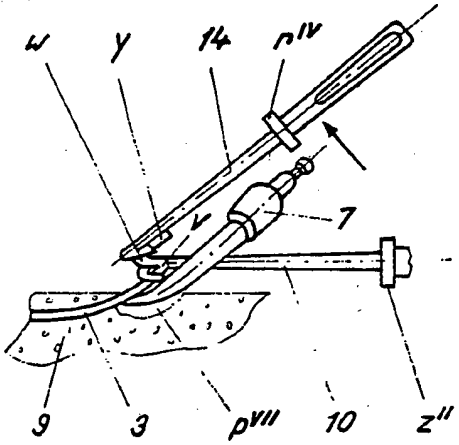

FIG. 79

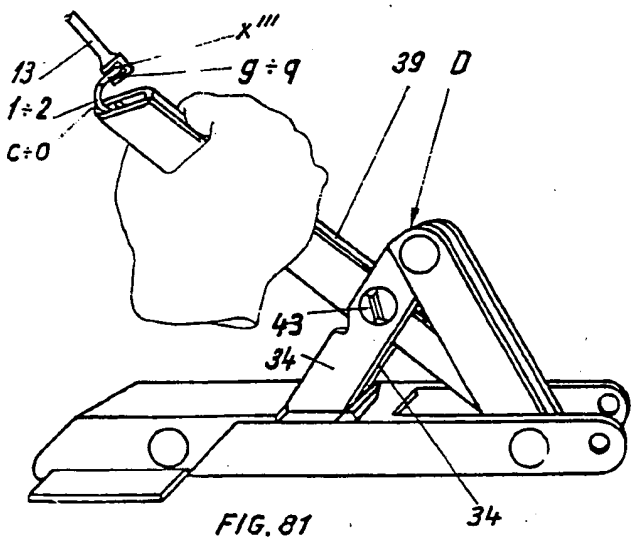

FIG. 81

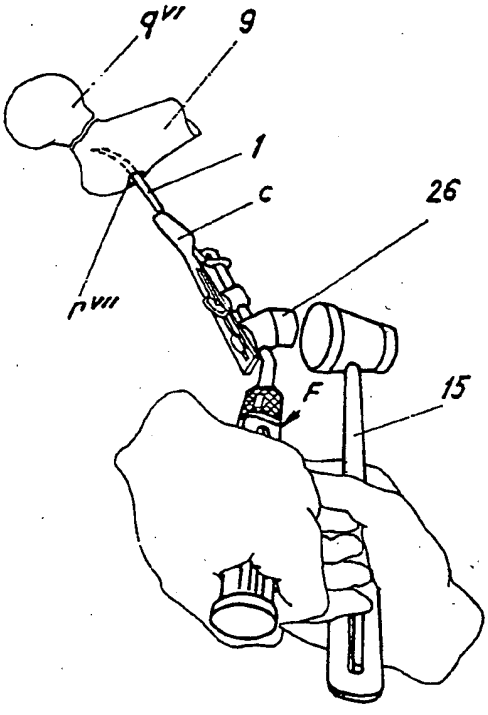

FIG. 82

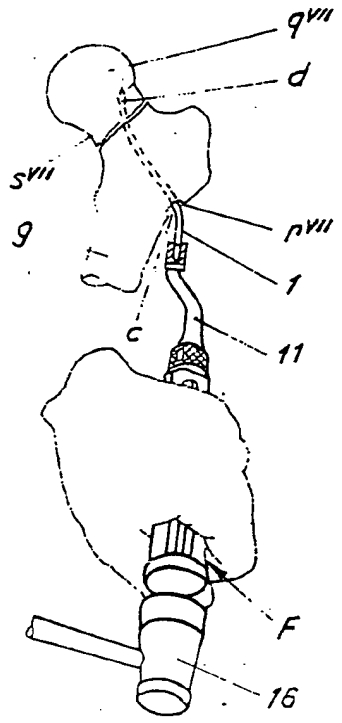

FIG. 83

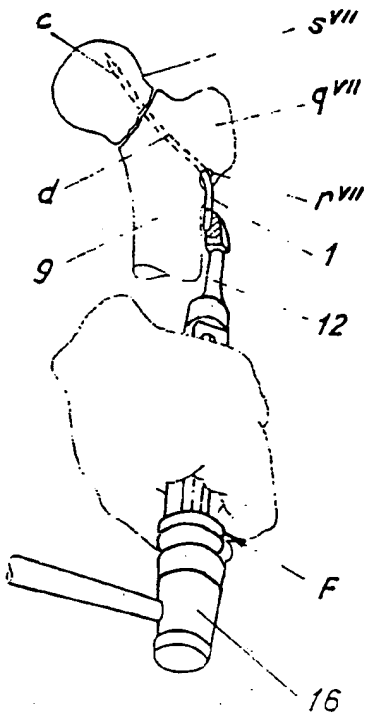

FIG. 84

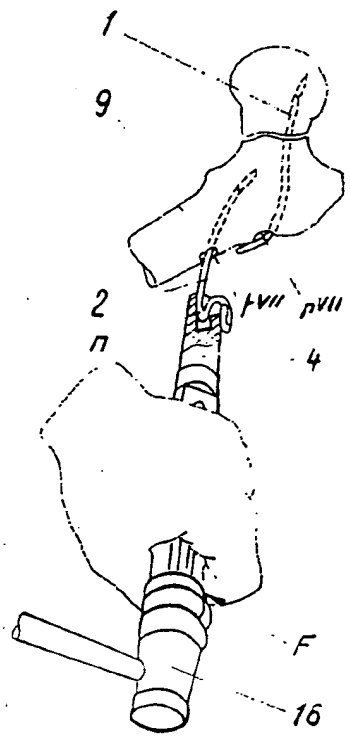

FIG. 85

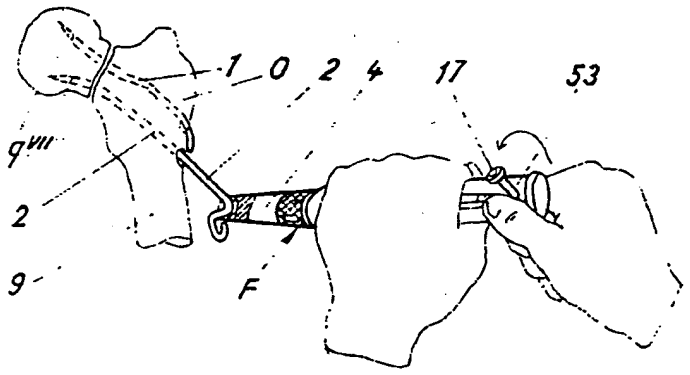

FIG. 86

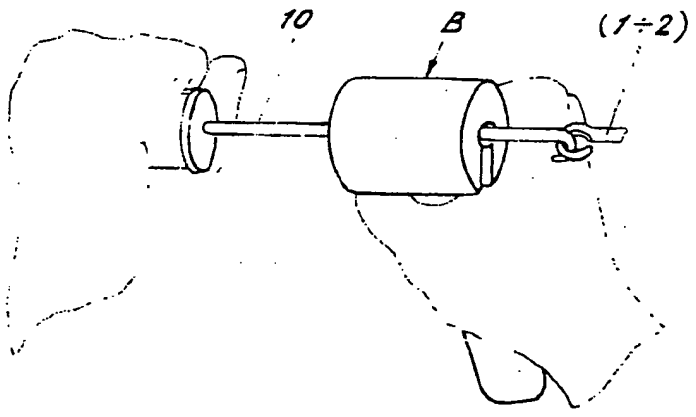

FIG. 88

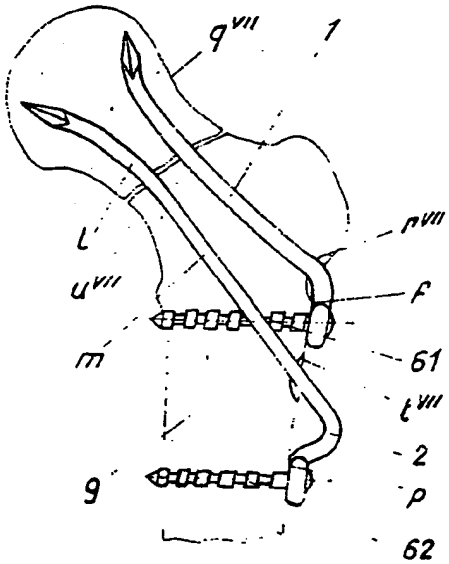

FIG. 87

INTERNATIONAL SEARCH REPORT

International Application No PCT/RO 86/00001

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: A 61 B 17/58

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
Int.Cl.[4]	A 61 B 17/56,17/58

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 4 483 335 (A.TORNIER) 20 November 1984 (20.11.84), see fig. 1; column 2, lines 1-8.	(1)
A	US, A, 2 579 968 (L.V.RUSH) 25 December 1951 (25.12.51), see fig. 13; column 4, lines 30-37.	(1)
A D	US, A, 4 055 172 (J.ENDER et al.) 25 October 1977 (25.10.77) & FR-A-2 237 609, see totality.	(1)
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A	GB, A, 1 389 427 (D.GALLUCCIO) 03 April 1975 (03.04.75), see fig. 3-5.	(1)
A	US, A, 4 011 863 (R.E.ZICKEL) 15 March 1977 (15.03.77), see fig. 1-5.	(1)

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
10 December 1986 (10.12.86)	15 December 1986 (15.12.86)
International Searching Authority	**Signature of Authorized Officer**
AUSTRIAN PATENT OFFICE	

Anhang zum internationalen Recherchenbericht über die internationale Patentanmeldung Nr.

Annex to the International Search Report on International Patent Application No. PCT/RO 86/00001

Annexe au rapport de recherche internationale relatif à la demande de brevet international n°.

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben. Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned International search report. The Austrian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

La présente annexe indique les membres de la famille de brevets relatifs aux documents de brevets cités dans le rapport de recherche internationale visé ci-dessus. Les renseignements fournis sont donnés à titre indicatif et n'engagent pas la responsabilité de l'Office autrichien des brevets.

Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
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